Evaluation of the South Australian Residential Energy Efficiency Scheme (REES)

Final Report

Prepared for: South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy

Prepared by: Carbon & Energy Team
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transport infrastructure | community infrastructure | industrial infrastructure | climate change

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Authorised by: _____ Date: 31 July 2013

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Executive summary

The South Australian Residential Energy Efficiency Scheme (REES) commenced on 1 January 2009, with an initial lifespan of six years. It requires large energy retailers to fund activities and investments focused on cutting GHG (GHG) emissions through improved household energy efficiency, particularly in low-income households. Its performance to date and its potential to make an ongoing contribution to South Australia's energy efficiency, greenhouse and welfare goals is the subject of this report.

The explicit aims of REES are to:

- improve energy efficiency and reduce GHG emissions within the residential sector;
- assist households prepare for likely energy price increases resulting from carbon emissions trading;
- reduce total energy costs for households, particularly low-income households.

REES allocates emission reduction and household energy audit targets to South Australian energy retailers on an annual basis. Compliance with emission reduction targets is achieved through the installation of approved energy saving appliances in South Australian homes. Each of these appliances is deemed to produce a level of energy and GHG emission savings over its life, which can be claimed by the retailer that is funding their uptake. REES obligations also stipulate that at least 35% of deemed emission savings, and all energy audits, are sourced from (or delivered to) low-income households that are part of what is known as the 'priority group'. Priority group householders are welfare recipients holding one of a range of pension or health concession cards, plus 'hardship' customers identified by the energy retailers themselves.

Under current target definitions, REES is seeking to cut South Australia's estimated future GHG emissions by an amount equal to 1,645,000 tonnes of carbon dioxide (t CO_2-e) over the long term, and support energy audits across 30,001 South Australian homes. The REES greenhouse abatement targets and their implication for changes to business-as-usual (BAU) residential energy use (as projected through modelling undertaken as part of this study) are shown in Table 1.

Table 1 REES GHG targets as a percentage of BAU residential emissions to 2020

Target	2009	2010	2011	2012	2013	2014
REES GHG target (t CO_2-e)	155,000	235,000	255,000	255,000	335,000	410,000
Program abatement as a percentage of expected BAU emissions to 2020	0.29%	0.73%	1.21%	1.69%	2.32%	3.10%

PERFORMANCE OF REES STAGE 1 (2009–2011)

Compliance under REES is policed by the Essential Services Commission of South Australia (ESCOSA). For the period 2009–2011, ESCOSA estimated the cost of appliance retrofit activities carried out under REES to be around $29.1 million (including equipment costs of around $6 million). These activities generated a stream of future energy savings estimated at around $135.7 million (in current value terms). This suggests around $4.66 of private benefit for every $1.00 of REES expenditure, in addition to the saving in GHG emissions generated (which did not attract an explicit price before 1 July 2012) – a very attractive social return on investment.

In the period to date, REES energy (and greenhouse) savings have been dominated by the installation of:

- insulation (in 2009 and 2010 – coinciding with support provided by the Commonwealth's Housing Insulation Program);
- compact fluorescent light globes;
- Low-flow shower heads;
- (more recently) standby power controllers – which were a major source of savings in 2012.

ESCOSA also puts the cost of household energy audit activities under REES at around $1.8 million for this period (out of the total of $29.1 million). But until now, there has been little independent evidence of the quality and impact of these audit activities.

Importantly, the independent analysis presented in this report broadly substantiates the strong economic pay-off from REES, and the associated greenhouse and energy savings. Modelling results for REES Stage 1 are shown in Table 2. This shows a benefit-cost ratio slightly below that reported by ESCOSA, but at 3.5 it still suggests a strong pay-off for the scheme, and the robustness of this result at substantially higher discount rates. Greenhouse savings from technology roll-out of 644.9 kt of CO_2-e also line up well with the ESCOSA result.

Table 2 Summary results and sensitivity analysis for independent modelling of REES Stage 1

Parameter	Discount rate (p.a.)		
	7%	5%	10%
Total energy saving (PJ)	4.11	4.11	4.11
NPV all energy savings ($m)	101.7	116.9	83.9
NPV energy saving (peak electricity) $m	71.8	81.7	59.9
Energy saving (off-peak electricity) $m	9.5	10.7	7.9
Energy saving (natural gas) $m	8.1	$9.7	6.4
GHG saving (kt CO_2-e)	644.9	644.9	644.9
Benefit-cost ratio	3.5	4.0	2.9

Issues such as 'additionality' and energy 'rebound' were also considered. These go to the reliability of the energy and greenhouse savings claimed as REES outcomes. In general, REES abatement and energy savings figures appear robust, with a conservative approach being adopted for compact fluorescent lights (CFLs) (which are becoming the residential lighting 'standard' following the phase-out of inefficient incandescent bulbs). We also note the need for continued scrutiny of household usage and deemed energy savings from power controllers (with both 'standby' and 'active' power termination units being distributed.

STAKEHOLDER FEEDBACK AND HOUSEHOLD SURVEY RESULTS

Stakeholder discussions and a survey of 539 households benefiting from REES retrofit and audit activities were conducted as part of this project. The sample size is sufficient to accept that the sample results obtained for priority and non-priority group households reflect true population results, with 90% confidence. Stakeholder feedback on REES tended to be broadly positive and align with expectations.

In broad terms, energy retailers do not welcome the obligations that REES imposes on them and seek the freedom to develop their business strategies – including community engagement and marketing strategies – on their own terms. There is some indication that more innovative retailers are moving down the path of broadening their energy service offering to include energy efficiency advisory and support services, although this would appear to be a small minority. And while there was a preference to be released from REES obligations, these were not seen as imposing an excessive burden – particularly by retailers operating in States with similar regulatory requirements. Consistency between schemes (and the potential to trade 'credits' between them) was seen as a key way of reducing the administrative burden imposed on those retailers by these kinds of obligations.

In contrast, welfare groups and the energy service providers who deliver on-ground installation and audit services are very supportive of REES and see substantial scope for it to be continued and expanded. However, many of the welfare groups contacted felt REES fell well short of its potential, and that both targeting (of disadvantaged households) and quality of the audit and follow up services could be improved. There was a concern that REES was not 'cutting through' to the most needy families (particularly in regional communities), building awareness and attitudinal change as well as it could, or achieving 'deep' enough change (that is, large enough savings per household).

These views bear comparison with the results of the householder survey. In the main, householder reaction to REES was very positive. And both retrofit and audit activities were seen as beneficial and embodying a high standard of service. For the retrofit activities, about 95% of households said that they were either happy or very happy with the quality of the installation job – and this proportion holds true for both the priority and non-priority group members (Figure 1).

Further, a little over half the respondents considered that they would have been either unlikely or very unlikely to have obtained the appliances provided to them by REES within the following six months on a business-as-usual basis (Figure 2). This provides some evidence of the effect of the scheme in achieving more rapid and innovative deployment of energy saving technologies.

Figure 1

REES survey result: Satisfaction with appliance installation

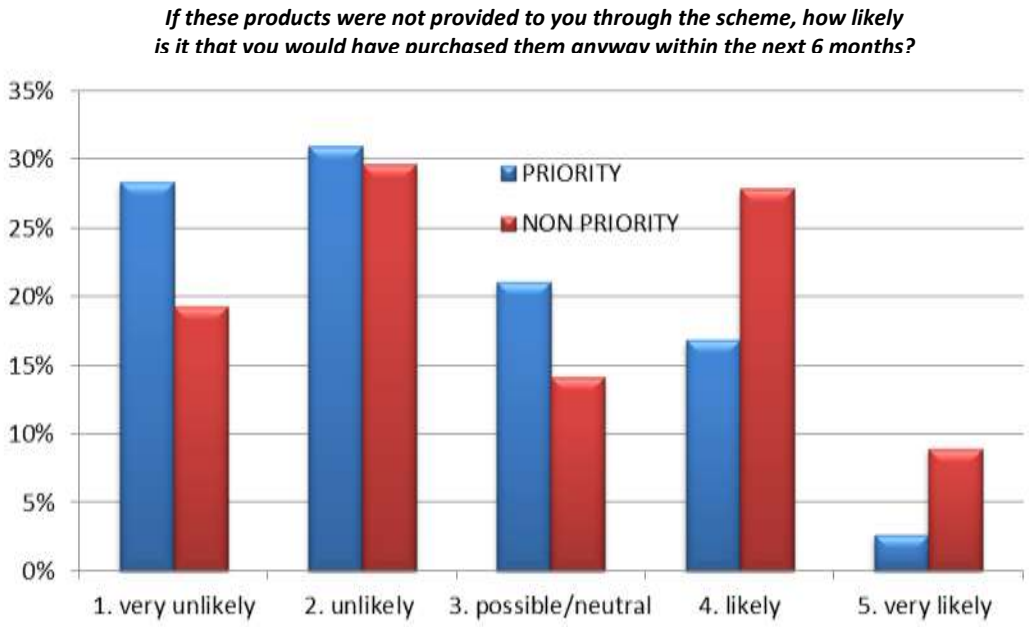


Figure 2

REES survey result: Accelerated diffusion of energy saving appliances

Audits (focused under REES only on households within the priority group) were also seen to be useful and professionally delivered, with nearly half the audits involving between 30 and 60 minutes of effort (according to householder recollections), and 12% of respondents reporting audits as taking more than an hour. Only 9% of audits were completed in less than 15 minutes (Figure 3).

Importantly, about 49% of respondents embraced all of the suggested energy saving actions, while 23% had adopted none of the actions at the time of the survey. The key single reason given for non-adoption was that the recommendation was too expensive to implement (28% of rejections).

Overall, around 90% of REES participants reported a good or very good experience with the scheme (Figure 4). Twenty-seven per cent of non-priority group households and 15% of priority group households reported that their experience with REES had led them to pursue other energy saving activities (Figure 5).

Further, examination of the extract from the REES database used to support the survey indicates stronger energy savings (per household) in areas where average taxable income is less than $55,000 per year, and some tendency for the average savings to grow in areas where income is below $45,000 per year. The analysis uses postcode information to match REES household data to statistical information on average income within the area in question. Importantly, it appears that at virtually any income level there are (on average) prospects for energy efficiency improvement. REES experience to date suggests (based on the key devices issued under the program) that an average of 4 tonnes of lifetime CO_2-e savings is readily achievable from individual households across the community. This pattern (based on the postcode areas of REES participants) is shown in Figure 6.

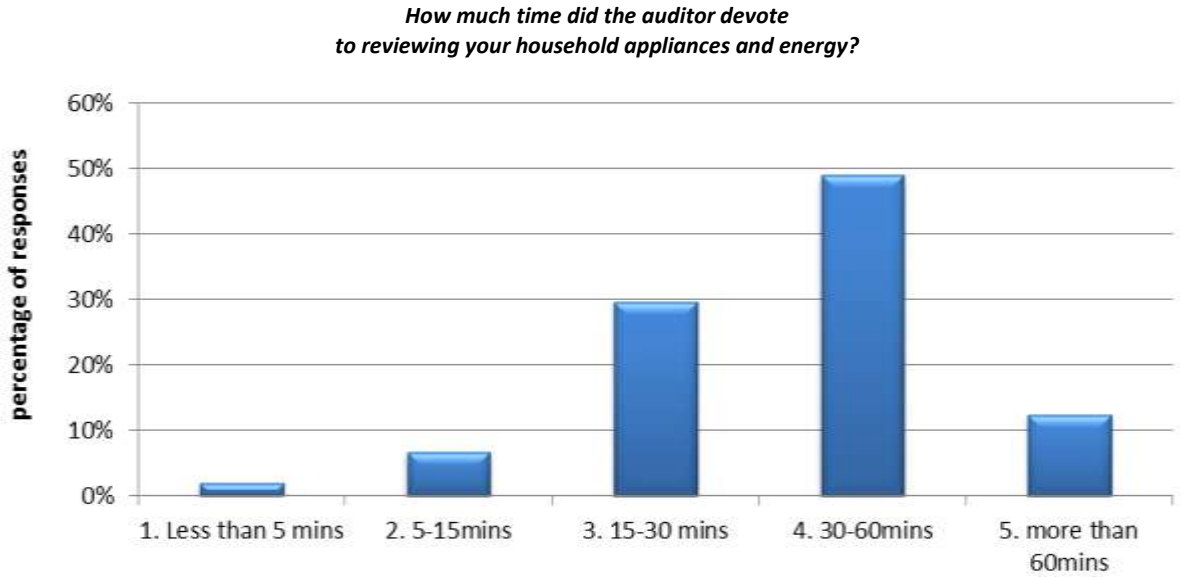


Figure 3

REES survey result: Time devoted to household energy efficiency audits

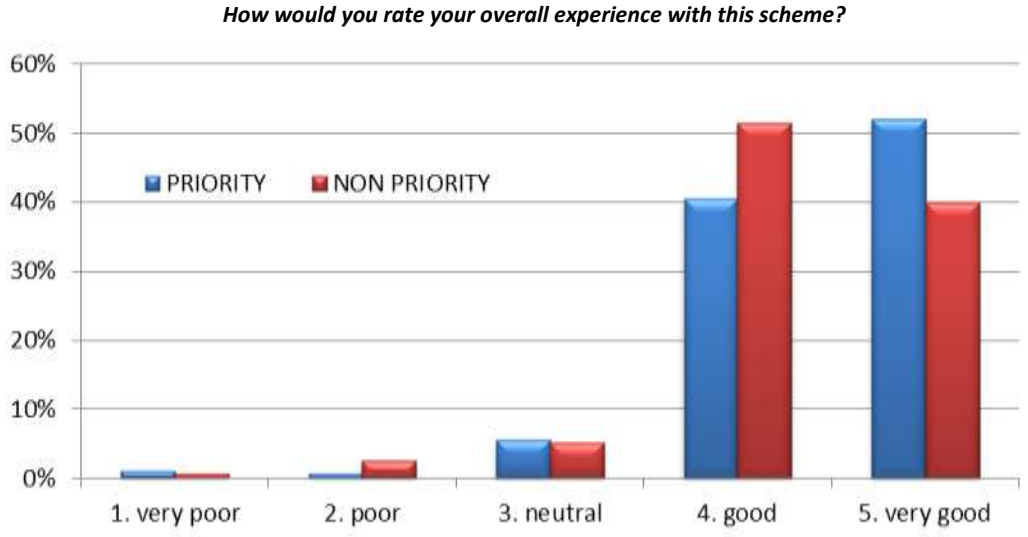


Figure 4

REES survey result: Overall satisfaction with REES activities

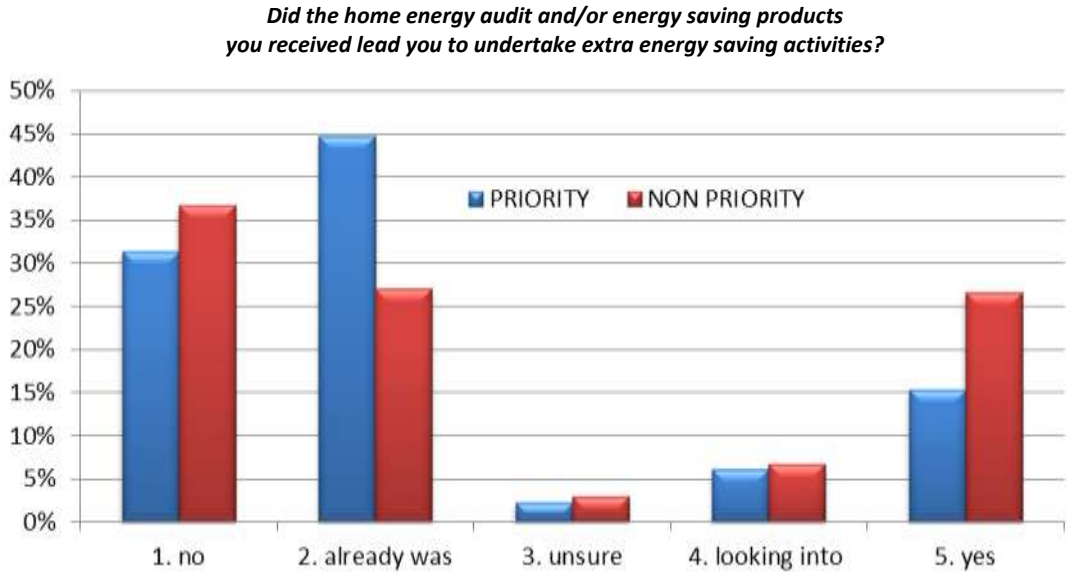


Figure 5

REES survey result: Awareness raising and multiplier impact of REES exposure

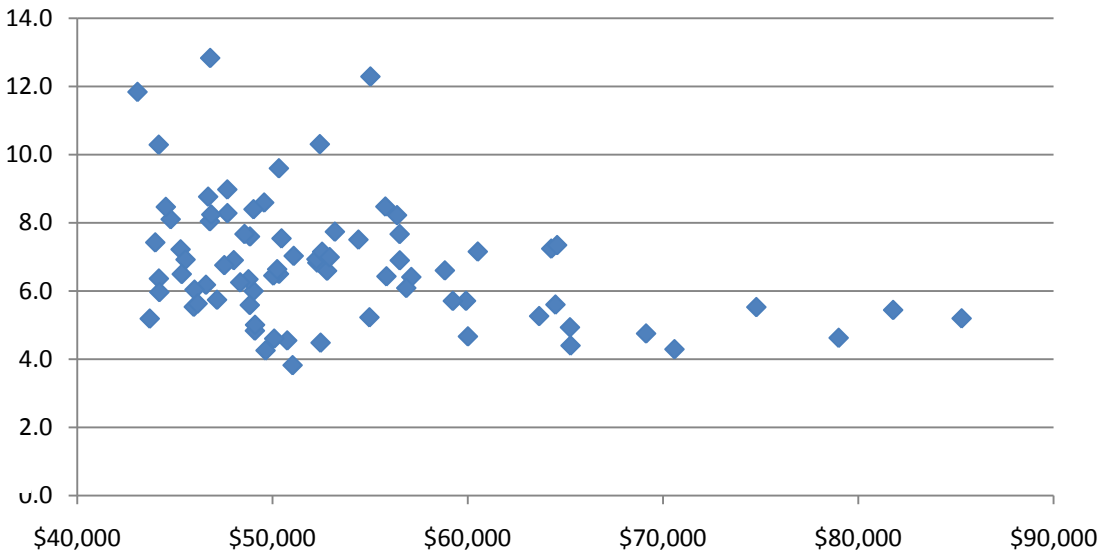


Figure 6

REES survey result: Average deemed GHG savings per household (t CO_2-e) versus average income levels (by postcode area)

The data also reveals a surprising pattern of savings being achieved across members of the priority and non-priority groups. While lower income households tended to realise greater energy savings than higher income households, the priority group households tended to realise smaller savings than non-priority group households. This is preliminary evidence to support the view – offered by welfare groups, *inter alia* – that the current priority group targeting is less than optimal. Possession of a concession card may not be the best indicator of economic disadvantage for the purpose of REES resource allocation. This result is based on a sample of 2,100 households. Deeper interrogation of the full REES dataset would be required to investigate these results more fully.

REES DESIGN AND COVERAGE

REES is one of a wide range of energy supplier obligation schemes operating in Australia and overseas. It shares some key similarities with the Victorian Energy Efficiency Target (VEET) scheme operating in Victoria and the Carbon Emissions Reduction Target (CERT) scheme operating in the UK. We understand that the recently enacted ACT Energy Efficiency Improvement Scheme (EEIS) has been substantially modelled on REES.

An overview of energy efficiency supplier obligation schemes beyond REES suggests that the South Australian scheme shares many features with other Australian and offshore schemes and, to date, has not set overly ambitious abatement (and energy savings) targets. REES has started slowly and applied a relatively simple design to good effect. While its requirement to prioritise energy savings among low income households is less common among schemes of this type, it is not unique – and there are legitimate efficiency and welfare arguments for promulgating this requirement. However, the requirement to undertake household audits within this group does appear to represent an innovative design feature.

Beyond a comparison of scheme design, consideration of relative performance becomes difficult – particularly where offshore jurisdictions are involved and it becomes necessary to take account of (potentially) large differences in energy and technology prices, climate, energy use patterns and regulatory regimes. However, a focus on the major Australian systems (i.e. REES, Energy Savings Scheme [ESS] and VEET) is illuminating (the ACT system has only just begun and has yet to establish a 'track record'). Table 3 provides a comparative overview of key performance outcomes for REES, ESS and VEET. BAU deviation estimates are derived from the in-house modelling conducted for this project. For energy and savings estimates, different deeming approaches and time horizons (for summing anticipated savings) can apply. This is particularly relevant for the NSW ESS scheme.

Table 3 A key comparison of REES, ESS and VEET schemes

	REES (2009–2011)	ESS (2011)	VEET (2011–2012)
Target deviation from sectoral BAU trajectory	1.21% (GHG saving)	2.5% (energy saving)	–
Energy saving (with deeming)	4.11 PJ (1,141,666.7 MWh)	2.96 PJ (823,224 MWh)	14.4 PJ (4,000,000 MWh)
Estimated GHG saving/credits created (t CO_2-e)	644,900	872,617	4,400,000
Estimated participant cost (A$)	27,308,000	$12,348,360	$48,400,00
Administrative cost (A$)	$1,792,000	$2,100,000	$5,310,000
Administrative cost per 'credited' CO_2-e tonne	$2.73	$2.41	$1.21
NPV benefit (A$)	$101.7m	$84.2m	$323.3m
Benefit-cost ratio	3.5	2.0	3.6

Notes: For ESS, reflects an 80% share of total administrative costs for ESS and Greenhouse Gas Reduction Scheme (GGAS); total net benefit of $24.56 per ESS certificate; participant costs estimated at half the 2011 average spot price (i.e. $30); and an ESS certificate conversion factor (for CO_2-e emissions) of 1.06 kg CO_2-e per kWh. For VEET, reflects an estimated average Victorian Energy Efficiency Certificate (VEEC) price for 2011–2012 of $22 and a CO_2-e conversion rate of 1.1 kg CO_2-e per kWh.

These numbers suggest significant variation in administrative costs per unit of abatement for the schemes, and a pattern of higher unit costs for REES. However, the significant differences in scale across the schemes in terms of the energy and emissions base and the level of savings targeted can be important to this result. Bigger schemes can generally achieve lower unit costs due to economies of scale – that is, the ability to spread fixed costs over a broader participant base and add extra participants and abatement relatively cheaply. The fact that the savings figures above omit the value of energy savings achieved in each jurisdiction is also pertinent. Importantly, the benefit-cost ratios reported pick up this factor. These suggest the strongly beneficial nature of REES and its close comparability with Victoria's VEET scheme in this regard.

POTENTIAL TO REFINE AND EXTEND REES

REES appears to be an effective policy tool. This view is shared by most stakeholders, although there is scope for some design tuning if the South Australian Government decided to recast or extend REES beyond its current configuration. While numerous design options exist, there are a few areas where a strong case for change can be made. Recommended changes and transitions are summarised in Table 4.

Table 4 Recommended changes and transitions to REES

Key issue	Recommendations
The value used for the GHG intensity of electricity supply in South Australia, for the purposes of calculating REES deemed savings values, is around 10% higher than the current estimate. This may mean that actual GHG savings under the scheme may fall short of the stated targets.	▪ That the value for deeming purposes of the GHG intensity of electricity supply in South Australia be no higher than the current value for Scope 2 and 3 electricity emissions in South Australia from the latest National Greenhouse Accounts Factors Workbook. ▪ That the greenhouse/electricity conversion factor for future time periods be based on best-available estimates of the expected future value of that variable, and updated as necessary based on new information.
Since the greenhouse intensity of electricity supply in South Australia is variable (and tending to decline significantly through time), there may be a need to continually increase the energy savings (and associated cost) under REES to meet a given GHG target.	▪ That the South Australian Government consider converting (or expressing) REES targets in energy metrics (such as gigajoules), rather than greenhouse metrics (such as tonnes CO_2-e).
Inclusion of the commercial sector, or small and medium enterprises, as potential beneficiaries of the scheme, would likely reduce the costs of abatement under the scheme, as well as enable higher targets to be met cost effectively.	▪ That coverage of the commercial sector, or small and medium-enterprises, as eligible entities under REES be considered for the post-2014 period, along with approaches that target the key efficiency barriers facing these business entities.
There is currently little verification of the quality or outcomes associated with energy audits under REES, along with some evidence (from our one-off survey) that at least some households appear to derive little value from the audits even if, overall, the majority of households report satisfaction with them.	▪ That retailers be required to retain the written reports of audits conducted on their behalf by service providers, and that ESCOSA audit a random sample of these reports on an annual basis. ▪ That a further survey of audit recipients be conducted prior to the completion of REES Phase 2, to inform decision-making with respect to the inclusion of audits in any extension of REES post-2014.

Key issue	Recommendations
A number of stakeholders are concerned that REES outcomes may not be optimally targeted to those most in need of its services.	▪ That the South Australian Government formalise a process to facilitate referrals by social welfare agencies of households from a wider priority group, including 'the working poor' and those at risk of energy hardship, regardless of whether those households are concession card holders or currently participating in retailer customer hardship programs.
There are opportunities to promote greater cost effectiveness and energy efficiency gains under REES, relevant to its current configuration.	▪ That administrators consider the nine minor design changes (listed in Section 6.2) that address issues such as transparency and information exchange, priority group eligibility and the energy audit focus and skill set.

The rationale for refining REES is underlined by scope for further energy efficiency improvement across South Australia and the prospect that energy price movements alone (even those reflecting the additional impost of a carbon price) will not be effective in driving awareness and take-up of this opportunity set.

Modelling undertaken as part of this report suggests that the scope for additional and highly cost-effective improvements in energy performance is substantial. The pool of low cost savings is far from exhausted – and this is true for both the residential and commercial sectors. Looking beyond the current scheduled termination of REES (and simply projecting the take-up of proven and ubiquitous technologies), indicates significant potential for cost, energy and greenhouse savings.

Table 5 shows the likely impact of extending energy efficiency initiatives (like REES) to the residential and commercial energy efficiency opportunity set, and achieving high adoption rates for a wide range of opportunities.

Table 5 Benefits and costs of REES (2015–2020 residential and commercial activities, 7% real discount rate)

Sector	Present value of costs	Present value of benefits	Benefit-cost ratio
Residential sector (Scenario 2)	$116m	$434m	3.7%
Commercial sector (high take-up rate)	$74.5m	$319m	4.3%
Combined residential and commercial sectors	$190.5m	$753m	4.0%

The analysis demonstrates that extending and evolving REES to cover commercial and residential opportunities would likely be highly cost effective, with a benefit-cost ratio around 4.0 over the period to 2020 (at a 7% real discount rate). That is, $1 of investment in energy efficiency can be expected to deliver around $4 worth of energy savings.

REES provides a basis for unlocking this savings potential, but will need to evolve to fit with the particular requirements and opportunities presented by different groups. A move from a residential focus to a business focus can dilute the need for explicit welfare objectives within REES, and require a re-focus and re-emphasis from appliance giveaways and free installation to targeted approaches that help improve energy efficiency awareness and investment. This will become increasingly important as larger energy savings and efficiency improvements begin to require higher levels of expenditure for individual energy users.

1 Task and approach

The Residential Energy Efficiency Scheme (REES) seeks to promote energy efficiency improvements among South Australian households, particularly those with low incomes. It does this by imposing annual greenhouse gas (GHG) abatement and service obligations on energy retailers, and a prescribed menu of technologies and activities that can be used to satisfy these obligations.

This report examines the outcomes achieved through REES, and its potential role in driving beneficial outcomes into the future. It was commissioned by the South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE).

1.1 Report focus and background

REES commenced on 1 January 2009, with an initial lifespan of six years. It requires large energy retailers to fund activities and investments focused on cutting GHG emissions through improved household energy efficiency. Its performance to date, and its potential to make an ongoing contribution to South Australia's energy efficiency, greenhouse and welfare goals, is now subject to external review.

Section 36 of the Electricity (General) Regulations 2012 and Section 30 of the Gas Regulations 2012 require REES to be reviewed before the end of 2013, with a particular focus on operation of the REES regulations and whether the scheme should continue beyond 2014. The South Australian Minister for Mineral Resources and Energy also seeks an assessment of:

- Part 4 of the Electricity (General) Regulations 2012, and Part 4 of the Gas Regulations 2012 (on a regulation-by-regulation basis);
- the objectives of REES and the effectiveness and efficiency of the scheme design in meeting them;
- how the scheme could transition if a National Energy Savings Initiative (NESI) is established.

As part of the review, the department held initial consultations with key stakeholders in July 2012 and released a discussion paper in October 2012 with a call for public submissions on the operation and future of REES. These submissions, and stakeholder follow-up, are an important input to the independent assessment of REES that is set out in the remainder of this report.

The key terms of reference are reproduced in Box 1.1

1.2 Key elements of REES

REES aims to achieve energy and greenhouse emission savings in the South Australian residential sector through energy efficiency improvements. A complementary aim of the scheme is to ensure that a significant share of these savings is focused on low income households. In this way, REES prioritises efficiency improvements and cost savings among disadvantaged groups as part of its impetus to improve residential energy performance within the State.

Box 1.1 **REES review: Terms of Reference**

1. Complete a cost-benefit analysis of the REES to date – utilising, where appropriate, existing studies/reports.
2. Benchmark the cost efficiency of the REES against other comparable schemes, including benchmarking administrative cost (for all parties) as a proportion of the total cost – utilising, where appropriate, existing studies/reports.
3. Identify significant REES deficiencies and assess the impact that these have on the efficiency and effectiveness of the REES.
4. Assess the appropriateness of the targets (type and quantum) as measures of success in meeting the REES's objectives.
5. Compare the cost effectiveness of the REES, in terms of meeting the scheme's objectives, with alternative scheme designs.
6. Compare the efficiency and effectiveness of the REES model with alternative options. These alternatives should include, but need not be limited to, variations in:
   - i fuel coverage;
   - ii sector and facility coverage (e.g. extension to part or all of the business sector);
   - iii performance indicators (e.g. primary or final energy consumption, peak demand reduction, emissions, qualitative measures);
   - iv obligated parties;
   - v performance incentives (e.g. to reflect priority targets);
   - vi eligible energy savings, including specific peak reduction;
   - vii eligible energy efficiency measures;
   - viii measurement, verification, reporting and compliance; and
   - ix trading of energy savings.
7. Comment on the merits of varying the above factors in terms of improving the cost effectiveness of the scheme should it be continued after 2014, taking into account the potential need to transition the scheme into a national scheme at some future date.
8. Assess the merits of the current funding model against alternative funding options. These should include, but need not be limited to:
   - i alternative funding source(s);
   - ii funding transparency;
   - iii ensuring that only efficient costs are passed through to customers.

As noted in the Issues Paper released by DMITRE in October 2012, the objectives of REES are to:

- improve energy efficiency and reduce GHG emissions within the residential sector;
- assist households prepare for likely energy price increases resulting from carbon emissions trading;
- reduce total energy costs for households, particularly low income households.[1]

Participation in REES is mandatory for all retailers of electricity and gas in South Australia who supply 5000 or more residential customers. Companies holding South Australian retail energy licences as at 1 February 2013, and the subset of retailers with REES obligations, are shown in Table 1.1. From 1 February 2013 responsibility for administering the licencing regime covered by the National Energy Retail Law (South Australia) was transferred to the Australian Energy Regulator.

Table 1.1 South Australia, energy retail licence holders, including those with REES obligations for electricity and/or gas customers (shaded)

Electricity retail licensees	Gas retail licensees
AGL Sales Pty Ltd	AGL South Australia Pty Ltd
AGL Sales (Queensland Electricity) Pty Ltd	Alinta Energy Retail Sales
AGL South Australia Pty Ltd	Australian Power & Gas Pty Ltd
Alinta Energy Retail Sales	Dodo Power & Gas Pty Ltd
Aurora Energy Pty Ltd	ENERGY Australia Pty Ltd (formerly trading as TRUenergy)
Australian Power & Gas Pty Ltd	Lumo Energy Pty Ltd
Cogent Energy Pty Ltd	Momentum Energy Pty Ltd
Diamond Energy Pty Ltd	Origin Energy Retail Ltd
Dodo Power & Gas Pty Ltd	Simply Energy
ENERGY Australia Pty Ltd (formerly trading as TRUenergy)	
ENERGY Australia Yallourn Pty Ltd	
ERM Power Retail Pty Ltd	
Flinders Power Holdings GmbH	
Lumo Energy	
Momentum Energy Pty Ltd	
Origin Energy Electricity Ltd	
Pacific Hydro Retail Pty Ltd	
Powerdirect Pty Ltd	
QEnergy Ltd	
Red Energy Pty Ltd	
Sanctuary Energy Pty Ltd	
Simply Energy	
TrustPower Australia Holdings Pty Ltd	

Source: ESCOSA website http://www.escosa.sa.gov.au/residential-energy-efficiency-scheme-rees.aspx 16 April 2013)

[1] DMITRE 2012, Review of the South Australian Residential Energy Efficiency Scheme (REES) – Issues Paper, October 2012, p. 8

In 2011–2012, there were around 735,532 residential electricity customers, and 387,799 gas customers in South Australia (noting the potential for a household to simultaneously belong to both groups). Energy retailers with REES obligations cover over 99% of these households.[2]

In line with their estimated share of residential customers and greenhouse emissions, obligated retailers are allocated a greenhouse emissions reduction target and a prescribed number of household energy audits each year. Emission reductions that count toward retailer targets are achieved through installation of eligible technologies in South Australian homes, with low income households being a priority group under the scheme.

The Minister for Mineral Resources and Energy is responsible for setting the design parameters and annual targets for REES. The Essential Services Commission of South Australia (ESCOSA) has administrative oversight, and has been charged with monitoring performance and ensuring compliance under the scheme. From 1 January 2012, ESCOSA also sets compliance activities under the Scheme.

Energy efficiency activities covered by the scheme include (but are not limited to):

- installation of efficient showerheads;
- installation of ceiling insulation in previously uninsulated ceilings;
- installation of draught proofing products;
- installation of compact fluorescent lights (CFLs) to replace incandescent or halogen lamps;
- replacement of electric resistance water heater or upgrade of gas water heater;
- installation of standby power controllers.

In order to deliver on their statutory obligations under REES, energy retailers must roll out (and receive 'credit' for) installation of energy saving technologies across South Australian homes, and deliver on their quota of sponsored home energy audits. Aggregate annual abatement and audit targets specified under REES are shown in Table 1.2.

As a sub-element to these obligations, at least 35% of annual greenhouse savings achieved under the scheme must come from energy efficiency improvements in the 'priority group' of households – that is, those holding recognised pension, health or energy concession cards. Retailers can also add 'hardship' households to the list. The 'priority group' of households is also the focus of the energy audit activities supported by the Scheme.

Table 1.2 REES annual greenhouse abatement and audit targets

Obligation	2009	2010	2011	2012	2013	2014
GHG reduction (t CO_2-e)	155,000	235,000	255,000	255,000	335,000	410,000
No of energy audits	3,000	5,000	5,000	5,667	5.667	5.667

Source: ESCOSA REES Targets, http://www.escosa.sa.gov.au/residential-energy-efficiency-scheme-rees/rees-targets.aspx, accessed 9 Jan 2013.

[2] For residential gas customers, energy retailers with REES obligations account for 100%. See ESCOSA publications (APR_2012-RetailEnergyMarketTimeSeriesData_00-01to11-12.xlsx)

The obligations form part of energy retailer licence agreements and are accompanied by penalties for non-compliance. ESCOSA has discretion to levy penalties in the following amount on energy retailers that significantly under-achieve on their targets:

- a base penalty of $10,000 for failing to meet a target; and
- $70 per tonne of CO_2-e equivalent (t CO_2-e) on a shortfall against a retailer's annual greenhouse abatement target; and
- $500 per audit on a shortfall in the retailer's home energy audit target.[3]

Payment of a penalty on a greenhouse target shortfall effectively eliminates the shortfall amount. However, significant under-achievement of the home energy audit target attracts both a penalty and a requirement to deliver on the shortfall amount (in addition to the normal target) in the following year.

However, the scheme also offers some flexibility in its annual compliance requirements. These elements include scope to:

- under-achieve on an annual target by up to 10% without penalty – provided the shortfall is carried over and made good the following year;
- carry over an over-compliance amount, and have it credited by ESCOSA against a future year target;
- transfer over-compliance amounts to other retailers, and have these count toward satisfaction of their target obligations.

Based on announced targets, REES is seeking to cut South Australia's future GHG emissions by 1,645,000 t CO_2-e over the long term, and support energy audits across 30,001 homes. According to ESCOSA's June 2012 report on REES, the scheme is largely on track to deliver the target amounts – with shortfalls and surpluses generally being within the compliance range.[4]

For Stage 1 of REES (spanning the three calendar years from 2009 to 2011), ESCOSA estimated the cost of appliance retrofit activities carried out under REES at around $29.1 million (with the actual cost of equipment purchases totalling about $6 million), versus a stream of future energy savings from these activities valued at around $135.7 million in current value terms. ESCOSA also puts the cost of household energy audit activities under REES at around $1.8 million for the period.[5] However, at the time of reporting, information on the contribution of these audits to subsequent household energy savings, and therefore the economic pay-off from this required activity, was not available.

In its June 2012 report, ESCOSA notes that the cost of REES obligations on energy retailers (to undertake audits and retrofits) is likely to translate into higher household energy prices. ESCOSA estimates that the cost of complying with REES in Stage 1 has added around $14 per year to the average South Australian household electricity bill.

[3] See ESCOSA (2012), Residential Energy Efficiency Scheme, Annual Report June 2012, p. 59.

[4] ESCOSA (ibid, pp. 15–17, p. 60) notes that Lumo Energy fell below acceptable compliance levels in 2009 and 2011. It achieved only 80% of its energy audit requirement (100 out of 125 households) and 84.4% (8,642 out of 10,240 t CO2-e - and fell short of the required 35% share for priority households) of its greenhouse abatement target in 2011. In 2009, it achieved only 69.5% of its target. In April 2012, Lumo Energy was issued a shortfall notice and ordered to pay a penalty of $243,750.

[5] ESCOSA (ibid, p. 38 and p. 50)

1.3 Key issues and approach

A fundamental question for REES is 'is it delivering benefits that exceed its cost?'. A further question is: 'is it the most cost effective way of delivering those benefits?' These are fundamental tenets of good program and policy design.

REES was implemented against a backdrop of increasing electricity prices in South Australia, and the prospect of further price rises under the influence of a future national carbon price. Energy efficiency improvement is a means of reducing the exposure of households to these energy prices, and finds its policy rationale in the notion that, for a variety of reasons, many residences over-consume and spend more on the delivery of energy 'services' than they need to. By substituting particular technologies and behaviours, these energy consumers can achieve the same level of warmth, light, refrigeration and other amenities – but at a lower cost. In achieving this outcome, energy efficiency is consistent with economic efficiency and an improvement in resource use and allocation.

Why would people waste their money like that? The answer has its roots in a number of 'market failures'. The first and most commonly cited of these is poor information. Energy consumers can be ignorant of, or under-estimate, the savings available to them. They may not have a reliable understanding of what energy efficiency can deliver, and 'over-consume' energy as a result. Inabilities to judge quality and performance, coupled with limited or incomplete property rights, can result in failures within the capital market and limit the ability of entities to access the funding necessary to purchase better performing equipment (even though that equipment could pay for its extra cost through energy savings in a relatively short period).

External costs and benefits that extend beyond the energy purchaser are also relevant to assessing program performance. The community as a whole has a stake in ensuring that maximum benefit is derived from the resources that it consumes, and that the prices paid for these resources at least reflect their value in the full range of alternative uses.

These are standard checks on the performance of any programs: 'are all significant costs and benefits being taken into account, and does the value of benefits generated by the program exceed its costs'. They are central questions in the analysis that follows.

The analysis also addresses the issue of optimised design and future impacts. For any given set of abatement opportunities, as abatement targets tighten, the cost of delivering an extra tonne of GHG saving will tend to rise. This is because of the tendency for the lowest cost or most profitable opportunities to be adopted first, before moving on to more expensive options for delivering on obligations. The welfare objectives of REES, and its requirement to source a minimum share of abatement from low income households as well as direct audit activity toward this group, also operate against this backdrop. However, the depth of low cost savings, the flow of new opportunities and development of better ways to service the opportunity set can all moderate the tendency toward higher costs. The rate at which these factors combine will determine the future cost of delivering future REES targets.

These issues, and the energy and economic implications of REES, are examined further in the following sections of this report.

2 Review of REES energy performance

According to the Bureau of Resources and Energy Economics (BREE 2012), the residential sector in South Australia accounted for around 33.9 PJ of energy in 2007–2008, and this had grown to 35.3 PJ by 2010–2011. Just over half of this was electricity, with another third accounted for by natural gas and LPG. Wood and wood waste provided about 4.8 PJ of the sector's energy consumption in 2007–2008 (i.e. around 14%). Overall, the residential sector accounts for about 8.3% of reticulated gas consumption in South Australia and 32.0% of electricity use. This is the resource base on which REES operates to drive more efficient use of scarce energy resources and consequential savings to households and the State's greenhouse emissions profile.

2.1 Energy use and savings in the South Australian residential sector

Table 2.1 provides a summary of residential energy use and associated CO_2-e emissions for 2007-08, the base year for REES which extends over the period from 2009 to 2014. The analysis is based on the Residential Baseline Study, undertaken for the Australian Government by Energy Efficient Strategies (EES 2008). In particular, the lighting and standby electrical energy were identified separately from appliance energy as major REES activities are aimed specifically at reducing these energy uses.

While standby power has not been a major target activity in the past, it is expected to be the 'next big thing' after CFLs in terms of low cost activities during the period from 2012 to 2014. There is evidence to suggest that standby power controllers are indeed now a major contributor to REES in Stage 2.

Table 2.1 Residential energy and CO_2-e emission mix in South Australia (2007–2008)

	Electricity (PJ)	Gas/LPG (PJ)	Wood (PJ)	Total (PJ)	Energy share	CO_2-e share-	CO_2-e (Mt)*
Space heat	1.30	3.28	4.46	9.03	32%	12%	0.45
Space cool	1.29			1.29	5%	7%	0.28
Space total	**2.59**	**3.28**	**4.46**	**10.33**	**36%**	**19%**	**0.73**
Water heat	2.66	4.15		6.81	24%	21%	0.78
Cooking	0.70	1.12		1.82	6%	6%	0.21
Lighting	2.06			2.06	7%	12%	0.44
Standby	1.16			1.16	4%	7%	0.25
Appliances	6.36			6.36	22%	36%	1.36
Total	**15.52**	**8.55**	**4.46**	**28.53**	**100%**	**100%**	**3.77**

* Calculated using NGGI Scope 2 emission factors

It can be seen that energy and emissions shares are not consistent, and this is particularly relevant for space heating for which gas/LPG and wood make significant contributions. Conversely, where electricity alone is used the emissions share exceeds the energy share due to the higher carbon intensity of electricity. The carbon intensity of electricity is declining in South Australia due to wind power, and this decline needs to be taken into account for calculating any future greenhouse abatement contribution from the energy savings achieved by REES. The private benefits to consumers are determined by energy prices, whereas the public benefits of emissions reductions must account for both costs and carbon intensity.

2.2 ESCOSA's analysis of REES Stage 1

Headline findings from ESCOSA's (June 2012) report on REES Stage 1 are highlighted below. In essence ESCOSA found:

- an implementation cost for REES Stage 1 of $29.1 million (inclusive of $1.8 million spent on energy audits);
- REES installations and audits in 166,819 South Australian homes;
- private benefits with a net present value (NPV) of $136 million for REES Stage 1;
- an estimated reduction in South Australian GHG emissions of around 657,000 tonnes over the life of the materials installed (based on deeming values for the various eligible energy savings retrofits and not including any contribution from home energy audit activities);
- annual electricity savings from REES equal to about 1.2% of annual residential consumption;
- a consequential benefit-cost ratio for REES Stage of 4.7.

However, ESCOSA also raised several issues associated with the reliability and interpretation of these results. These included:

- The valuation and additionality of private benefits accruing to the program:

  > …The deemed values and underlying energy savings are based on engineering estimates of what energy savings can be achieved by the various REES energy efficiency activities above business-as-usual over the life of the materials installed (i.e. above that which would be achieved in the normal course of events as households replace items as they wear out) (ESCOSA 2012, p. 35).

- The accuracy of deeming rates and their reliability in estimating energy and greenhouse savings under the scheme:

  > …There is debate over the valuations made for these deemed values, not the least concerning how householders will interact with the devices. For example, in the case of insulation, a higher level of savings may be taken in the form of comfort (ESCOSA 2012, p. 35).

- The valuation of public benefits from the scheme:

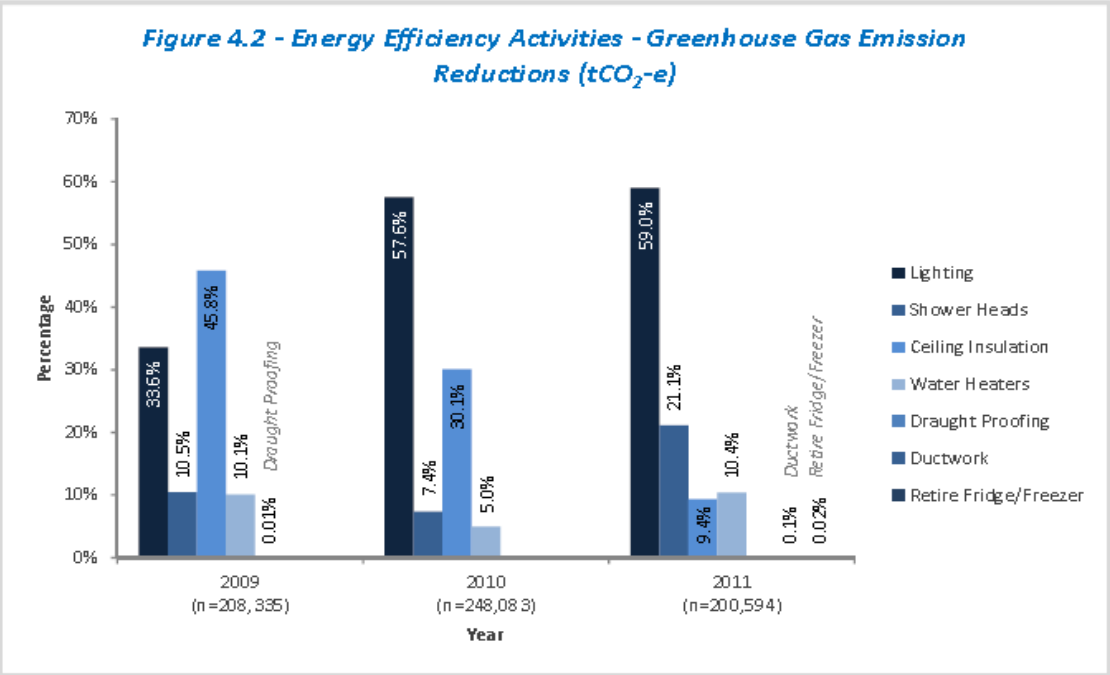
  > REES Stage 1 public benefits represent 657,011 tonnes of CO_2 (t CO_2-e) savings at a cost of $44 per tonne CO_2-e…Additional public benefits (i.e. additional to the benefits from reduced carbon emissions) might include any resulting reduction in peak electricity supply costs leading to a reduction in overall energy prices which benefits all customers…(ESCOSA 2012, pp. 40, 41).

Key dimensions of activity occurring under REES Stage 1 are also described by ESCOSA in its 2012 report. Representations of these outcomes are shown in the following figures taken from the ESCOSA report. These describe:

- the dominance of lighting, shower heads and ceiling insulation as a source of abatement in the first 3 years of REES operation, with the share of insulation falling dramatically in 2011 (Figure 2.1);
- the distribution of activities and abatement between the priority group and non-priority group in Phase 1 (Figures 2.2 and 2.3);
- the dominance of metropolitan locations in the geographic distribution of energy audits under Stage 1 – notably locations in and around Adelaide also dominated the roll-out of retrofits and abatement activity during Stage 1 (Figure 2.4).

In terms of overall emission savings in Stage 1, the distribution was as follows:

- 50.4% from lighting (predominantly exchanging incandescent lights with CFLs;
- 28.8% from ceiling insulation, and 20.8% from showerheads / water heaters.



Source: ESCOSA (2012), Residential Energy Efficiency Scheme
– Annual Report: Administration of the Scheme for Stage 1, (June), p. 23

Figure 2.1

Activity shares of emission reduction in REES Stage 1

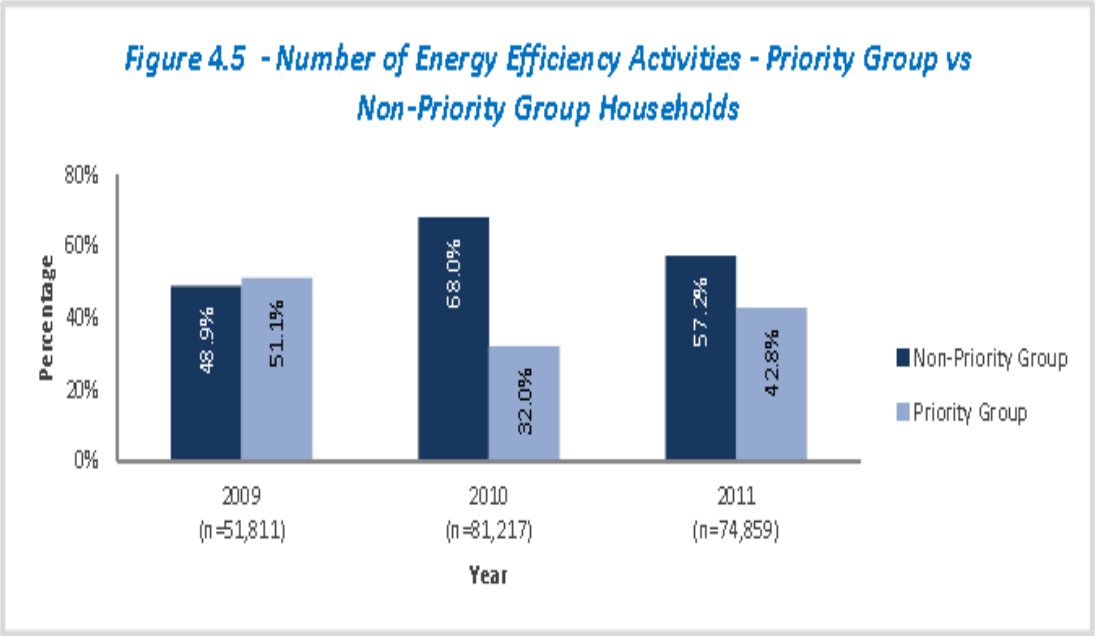
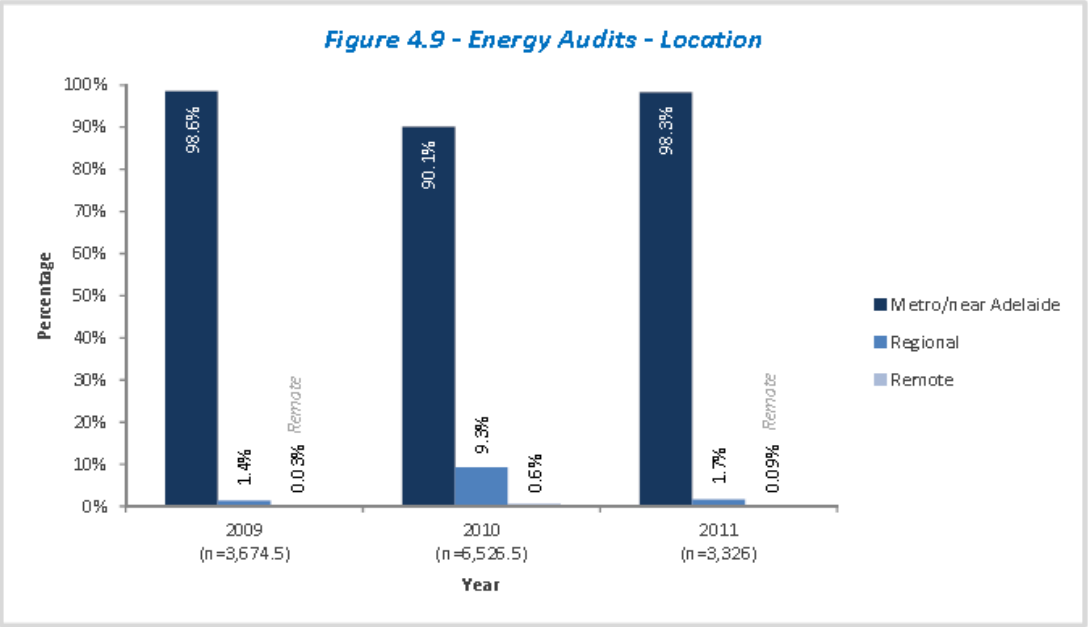


Figure 2.2

GHG abatement shares in REES Stage 1



Source: ESCOSA (2012), Residential Energy Efficiency Scheme
– Annual Report: Administration of the Scheme for Stage 1, (June), p. 28

Figure 2.3

Geographic distribution of household energy audits in REES Stage 1

Another key characteristic of REES performance under Stage 1 is the distribution of costs under the scheme. ESCOSA provides an estimated breakdown of costs incurred in the administration and operation of REES during Phase 1 – with an allocation of ESCOSA costs across major activities. Importantly, the analysis accessed by ESCOSA indicates that around 64% of the total costs incurred under Stage 1 were due to 'retailer administration and contracting costs' – which excludes the cost of the actual devices given to households under REES (ESCOSA 2012, p. 46). A graphical representation is provided in Figure 2.4.

These represent significant 'transaction costs' for the scheme. Although some labour component will inevitably be associated with the delivery and installation of new energy efficiency devices – particularly in situations where householders lack the knowledge and means to actively seek out and install these devices on their own – it is legitimate to envisage a scheme where these costs become increasingly small. This would be a measure of success for a scheme that changes the knowledge base and culture around energy efficiency to the point where householders seek out efficient technologies themselves and install them on an as-required basis. Part of the observed result is no doubt due to the preference for multiple low cost energy saving devices that has characterised abatement activity in Phase 1. CFLs and showerheads can be readily stored and transported door to door, and are relatively easy and quick to install. For an individual installation – and per unit of energy or CO_2-e saved – labour costs will tend to represent a major share of the total cost.

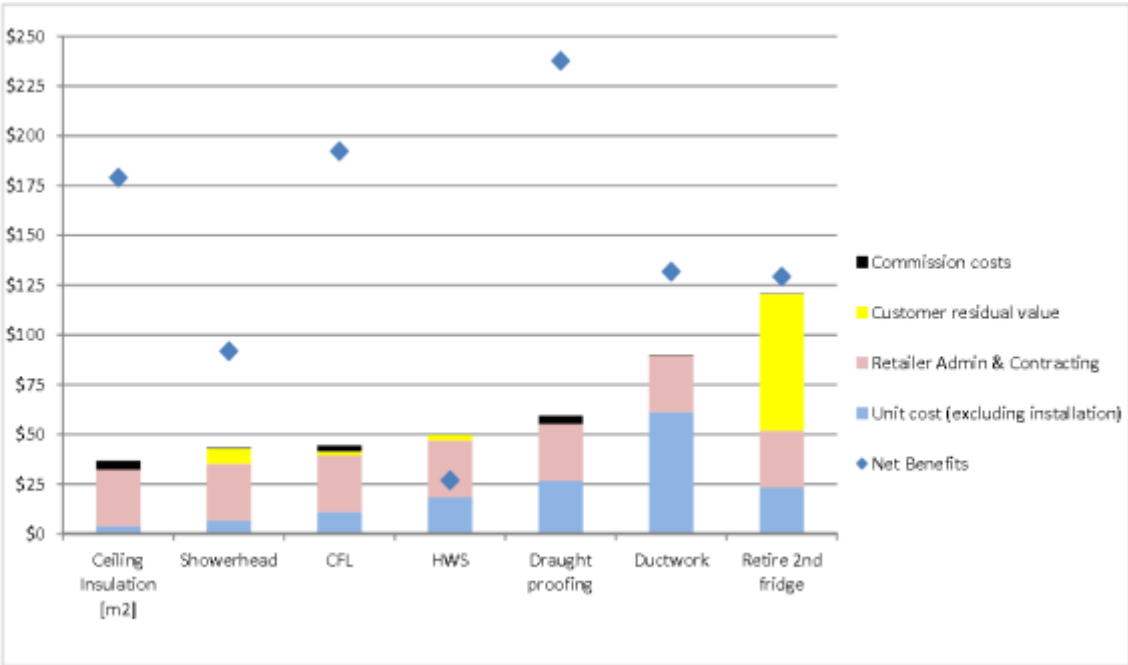


Figure 2.4

Cost breakdown of activities under REES Stage 1

2.3 A fresh look at the performance and impacts of REES

An alternative model of appliance costs and usage patterns was applied as a 'check' on the ESCOSA analysis of REES outcomes. The alternative modelling was undertaken by Energy Efficient Strategies, a specialist in the performance characteristics of energy efficient technologies in the residential sector. Key aspects of autonomy between the modelling carried out by Energy Efficient Strategies and that of ESCOSA includes:

- independent residential sector energy and greenhouse projections
- household appliance usage and efficiency profiles
- household energy mix profiles
- energy efficiency deeming rates (based on REES 2009 rates)
- projected South Australian energy costs.

Activity information on the number of device retrofits and overall scheme costs was taken from ESCOSA's published work.

Importantly, ESCOSA (acting on expert advice) has adjusted deeming rates from time to time to reflect changes to the performance and service life of particular technologies and also 'baseline' developments such as the adoption of new minimum energy performance standards. As these standards increase, the deeming rate – meant to reflect the 'beyond BAU' level of abatement achieved – tends to decline.

Notably, the deeming rates are a function of the expected usage and life (e.g. an average of 3 hours per day for 2.1 years) of an energy saving item, the expected GHG emissions intensity of the energy saved and an adjustment for uncertainty (e.g. sampling for usage and lifespan each display a coefficient of variation of 25%, and hence some downward adjustment of the 'average' value might be applied to arrive at a 'conservative' value for the deeming rate). A discussion of principles applied to the calculation of deeming rates, as reflected in recent advice to ESCOSA, is provided in Box 2.1.

2.3.1 Baseline energy consumption in the residential sector

An energy baseline projection for the South Australian residential sector is the starting point for the independent modelling analysis. The baseline, reflecting past energy consumption for South Australian households (by energy source) and the influence affecting future demand such as population growth, autonomous energy efficiency improvement and expected changes in relative prices is shown in Figure 2.5 (with the inset showing the scale of these changes against total consumption). It depicts underlying growth in energy consumption from 2009 to 2012, and a slowdown thereafter. Under BAU conditions, consumption is expected to reach about 28.3 PJ in 2011 and decline to around 27.3 PJ by 2020). Energy efficiency gains under REES drive these outcomes lower.

Applying greenhouse intensity parameters to the residential energy mix and superimposing the energy savings from technologies that have been distributed under REES gives an energy and emissions savings profile. The estimated GHG emissions savings from REES Stage 1 are shown in Figure 2.6. The growing influence of renewable energy in the South Australian energy mix from 2008 is evident from comparing the emission baseline in Figure 2.6 with the energy baseline in Figure 2.5.

Box 2.1 **Principles for calculating deeming values for energy efficient appliances**

Deeming values are typical GHG savings (t CO_2-e) and must be informed by credible research, a defensible methodology and calculated having regard to the climate zone/s, typical housing stock, and energy use practices for South Australia. Calculations should include consideration of the following.

- **Base case** – Current typical energy use where an inefficient product is used or where no efficient product is installed, using recognised benchmarks where available.
- **Improvement on the base case** – What, typically, would be the difference in energy use by installing or using an efficient product.
- **Lifetime** – The typical period of time the activity can realistically be expected to result in energy savings which are additional. To account for future uncertainties, a maximum lifetime of 20 years should apply, although a longer lifetime may apply if substantiated through appropriate research findings.
- **Adjustment factors** – Energy savings may need to be adjusted where it is necessary to account for, for example, the extent to which the energy savings will be taken as improved thermal comfort, likelihood of performance changes over time, changing BAU, or an adopted regulatory change that is to be apply in the future.
- **Climate zones** – Whether there is a material difference in the savings achieved when the activity is implemented in different South Australian climate zones.
- **GHG coefficients, both current and projected over the life of the activity** – These are as published by the Commonwealth Department of Climate Change.

Source: EnergyConsult (2011), Residential Energy Efficiency Scheme Review of Energy Efficiency Activities Stage 2, Report to ESCOSA, Feb 2011, p. 9.

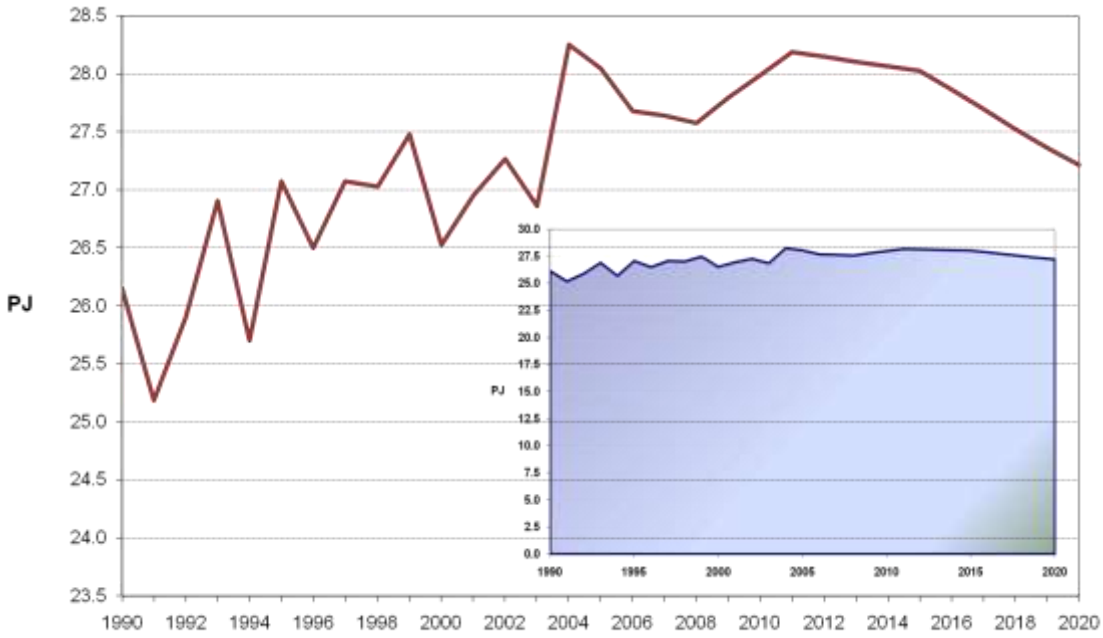


Figure 2.5

Observed and projected BAU
– South Australian residential energy consumption (1990–2020)

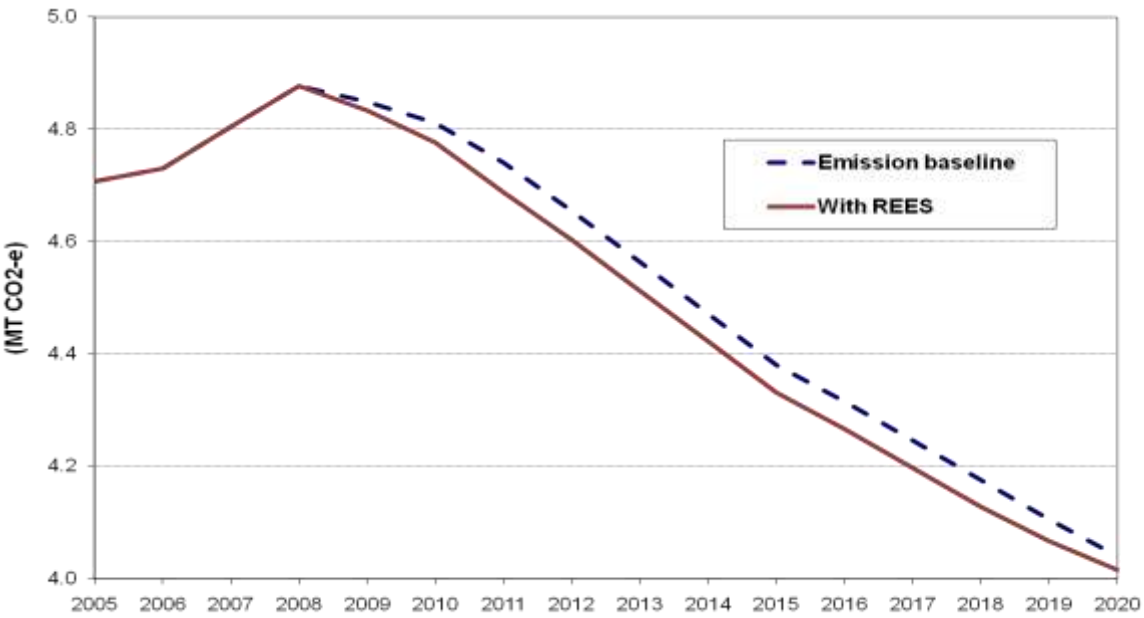


Figure 2.6

Estimated GHG emissions savings from REES Stage 1

Relevant projections for the greenhouse emission intensity of various South Australian household energy sources (as used by the model) are shown in Table 2.2.

Table 2.2 Projected GHG emission intensity of South Australian residential energy use (kt CO_2-e/PJ)

Energy source	2009	2012	2015	2018	2021
Electricity	270.91	256.18	241.67	238.33	235.00
Natural gas	70.7	70.7	70.7	70.7	70.7
LPG	65.2	65.2	65.2	65.2	65.2
Firewood (closed)	4.4	4.4	4.4	4.4	4.4
Firewood (open)	57.7	57.7	57.7	57.7	57.7

According to the modelling and REES forward emission factors, REES Stage 1 is expected to generate 640,000 tonnes of greenhouse savings over the life of the installed equipment. In line with ESCOSA advice, this is associated with outlays under the program of around $29.1 million over the period 2009–2011. This is depicted in Figure 2.7. This is a slightly lower outcome than estimated by ESCOSA (657,000 tonnes CO_2-e), but well within the bounds of uncertainty associated with a 'baseline-credit' program of this nature.

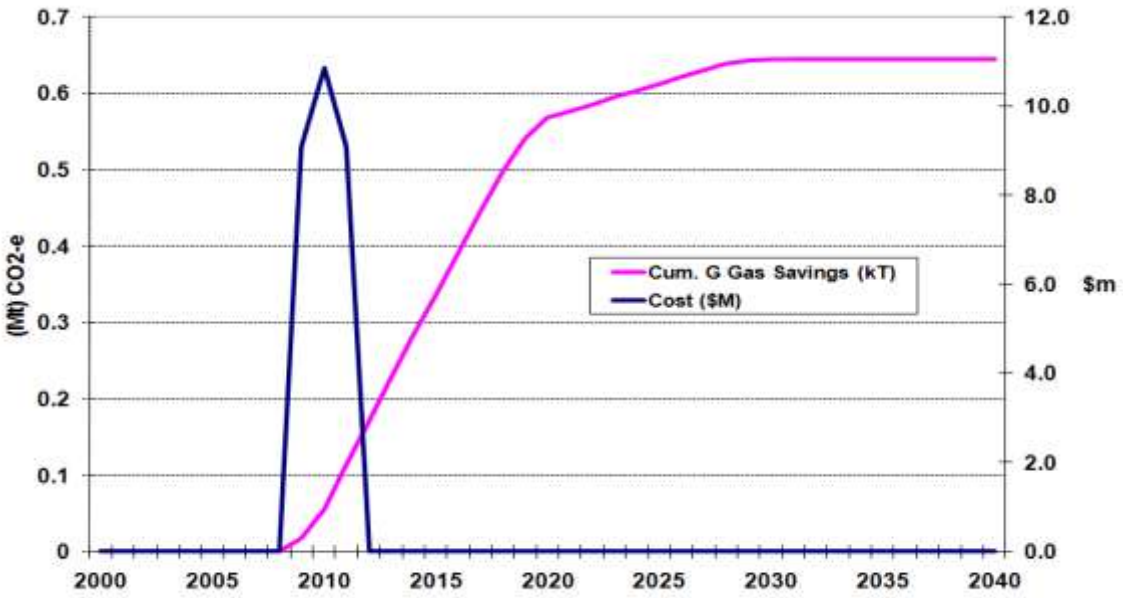


Figure 2.7

REES Stage 1 cost and abatement outcomes

However, an issue of precision arises with respect to the reliability of the electricity emission factors (and GHG savings per megawatt-hour of reduced electricity consumption). We understand that REES greenhouse projections and crediting rates are based on an emission intensity for electricity averaging around 900 kg/MWh, whereas current intensity is estimated at 810 kg/MWh (drawing on Scope 2 and 3 emission factors that reflect emissions in generating and supplying end-use energy) and expected to decline further into the future. This has the effect of over-rewarding reductions in electricity consumption relative to other household energy sources, and over-stating the reported contribution of REES to national greenhouse reduction targets.

Comparison of REES published greenhouse targets (Table 1.2) with expected BAU emission levels to 2020 is an indicator of the level of 'ambition' for the associated annual abatement obligations (Table 2.3). Taking an emission outlook to 2020 suggests a ratcheting target mechanism that moves from modest levels in Year 1 (2009) to around a 1.12% cut on cumulative BAU emissions in 2011, and a 2.5% cut on cumulative emissions when the current schedule of targets ends in December 2014. However, to the extent that REES credits, lifelong savings and some installed technologies will continue to deliver energy savings beyond 2020, these figures can overstate the proportional cuts demanded by REES and the extent of the deviation on BAU represented by the targets.

In terms of the economics of the program, the modelling yields estimated energy savings valued at $101.7 million (using a 7% per annum real discount rate), and a benefit-cost ratio of 3.5 based on that figure. Summary results and sensitivity analysis using alternative discount rates (reflecting different valuations of the future savings stream) are shown in Table 2.4.

Table 2.3 REES GHG targets as a percentage of BAU residential emissions to 2020

	2009	2010	2011	2012	2013	2014
REES GHG target (t CO_2-e)	155,000	235,000	255,000	255,000	335,000	410,000
Program abatement as a percentage of expected BAU emissions to 2020	0.29%	0.73%	1.21%	1.69%	2.32%	3.10%

Differences in discount rate make relatively minor impacts on the benefit-cost ratio achieved by the scheme between 2009 and 2011, with real discount rates between 5% and 10% per annum yielding a benefit cost ratio in the range of 2.9 to 4.0. The central estimate (at 7% per annum discount) is a benefit cost ratio of 3.5. This compares with the ratio estimate reported by ESCOSA of 4.7.

Table 2.4 Summary results and sensitivity analysis for independent modelling of REES Stage 1

Parameter	Discount rate (p.a.)		
	7%	5%	10%
Total energy saving (PJ)	4.11	4.11	4.11
NPV all energy savings ($m)	101.7	116.9	83.9
NPV energy saving (peak electricity) $m	71.8	81.7	59.9
Energy saving (off-peak electricity) $m	9.5	10.7	7.9
Energy saving (natural gas) $m	8.1	$9.7	6.4
GHG saving (kt CO_2-e)	644.9	644.9	644.9
Benefit-cost ratio	3.5	4.0	2.9

Overall, the analysis supports the conclusion that REES Stage 1 has provided a strong return on the money invested in pursuit of the greenhouse targets mandated through legislation. These benefits are valued on the basis of energy savings only, and are increased if a value is attributable to the greenhouse savings that they generate. After 1 July 2012 this value is explicit in the energy price (for the vast bulk of residential energy derived from fossil fuel). Prior to 1 July 2012, REES is estimated to have saved about 143,000 t CO_2-e.

Importantly, REES's focus on the greenhouse savings from energy efficiency is squarely aimed at improving the economic efficiency of energy use and takes GHG abatement as a 'bonus' alongside the benefits of smarter energy use. There is compelling evidence from the benefit-cost ratios achieved to suggest that these GHG savings are being achieved at a substantial negative cost. That is, society is not only saving money by substituting technology for energy to deliver the same energy services, it is deriving an extra benefit in the form of reduced GHG emissions.

The estimated cost effectiveness of particular technologies deployed under REES Stage 1 is shown in Table 2.5. It compares the amount spent under REES Stage 1 on the installation of various devices to save $1.00 worth of energy in benefiting households.

Table 2.5 Relative costs and pay-offs of REES Stage 1 retrofits

Device	Installed device cost	Investment to achieve $1.00 in energy savings (NPV)
Install R3.5 to ceiling (per m^2)	$8	$0.18
Install CFL 23W+ (10,000 h)	$13	$0.16
Install CFL 15-22W (10,000 h)	$13	$0.22
Install CFL 6-14W (6-9,000 h)	$13	$0.79
Install low-flow shower head	$81	$0.35
Install ductwork (large air-conditioner)	$225	$0.33
Retire secondary refrigerator	$393	$0.59
Standby power controller (AV use)*	$29.5	$0.07
Standby power controller (IT use)*	$29.5	$0.41

* Standby power controllers are a significant energy saving technology under REES Stage 2.

Service provider preferences for households in and around Adelaide can also be understood in terms of an effort to keep costs down. During Stage 1, REES delivered benefits to about 23% of South Australian homes (166,819 out of around 735,000).

As we have seen, the labour and overhead cost component of retrofit programs such as REES can be relatively high. The challenge for policymakers looking ahead is to find better ways to encourage and ensure that householders make good judgements around their current and future equipment purchases, and have the capacity to act on those judgements.

3 Expanded analysis of costs and benefits

While prima facie analysis of REES largely confirms ESCOSA's broad depiction of its performance, a range of factors can impact on the estimation of savings under the scheme. These relate to the ability of the scheme to drive new outcomes and be appropriately credited for these, and appropriate accounting for costs and benefits under the scheme. A brief discussion of elements with the potential to impact on the assessment of REES as a policy tool, and the economic and greenhouse outcomes it achieved during Stage 1 is provided below.

3.1 Additionality and deeming

'Additionality' is a well established requirement in public policy — and indeed in everyday consumption and investment behaviour. It represents the desire to ensure that expenditures induce a flow of benefits beyond those that would have otherwise been generated. At its core additionality is essentially a test of value for money.

Additionality has become an increasing focus for policymakers in the area of environmental management, and is a central theme in the creation of offset 'credits' for the international market for GHG (GHG). The international rules for measurement, reporting and verification (MRV) in these offset markets strive to ensure that only GHG mitigation projects whose viability is critically dependent on the availability of a future stream of credit income, are allowed to earn and supply credits.

The GHG Management Institute of Princeton University, describes the principle thus:

> Conceptually, additionality is a determination of whether a proposed activity will produce some 'extra good' in the future relative to a reference scenario, which we refer to as a baseline. In other words, additionality is the process of determining whether a proposed activity is better than a specified baseline.
>
> …Overall, additionality is about assessing causation. It is about deciding if a proposed activity is being caused to happen by a policy intervention. We perform this assessment by deciding if a proposal is different than its baseline, which is defined as the scenario absent the same policy intervention. The concept of additionality is further grounded in an assumption that policy interventions can cause behavior change.
>
> Gillenwater, M. (2012), What is Additionality? Part 1: A long standing problem,
> Discussion Paper No. 001 Version 03 (January), GHG Management Institute, p. 3

For the purposes of REES – where regulation requires energy retailers to pay the cost of appliance installation and energy audits – the question of causality boils down to whether REES has generated emission and energy efficiency outcomes that would not otherwise have occurred, and estimating the size of those outcomes.

On the face of it, REES has generated some powerful benefits. For an expenditure of around $29 million (on equipment installation by service providers) it is expected to result in over $136 million worth of energy savings, representing around 0.6 PJ of combined electricity and gas. As a consequence of this energy saving, it is also expected to cut South Australia's future GHG output by about 600,000 tonnes.

However, how can we be sure that these savings would not have occurred in the normal course of events? It is feasible that in some cases REES might simply have provided for free some energy saving devices that a householder was about to purchase anyway. Or perhaps they were likely to purchase them in the next week, month or year. Under these scenarios, REES acts to accelerate the delivery of a future outcome, rather than bring that outcome into existence in a paradigm where it would not otherwise occur. Through periodic recalibration of 'baselines' deeming seeks to adjust for these influences, but must deal with the perennial problem of having to make 'reasonable' predictions about future outcomes and behaviours such as technology uptake levels, energy mix and emissions intensity. These are fundamental challenges shared by all programs that seek to quantify and credit avoidance of expected future outcomes.

Determining deeming rates is an involved empirical exercise, and the subject of periodic analyses commissioned by ESCOSA. Critically the accuracy (or otherwise) of deeming rates – and the eligibility of particular technologies for 'crediting' under REES – will be key factors in the cost effectiveness achieved under REES. Products that are increasingly likely to be adopted as part of BAU have diminishing claims to additionality, and should exhibit a declining deeming rate.

Notably, the pattern of abatement achieved under REES Stage 1 is focused around a handful of retrofit technologies. Improved lighting efficiency (mainly through substitution of CFLs for incandescent bulbs), provision of low-flow showerheads, and installation of ceiling installation account for about 90% of the emissions savings claimed by the Scheme.

However, consideration of the changes (and energy and greenhouse savings) achieved by the Scheme also needs to take account of the following background developments.

- Nationwide restrictions on the sale of general purpose tungsten filament light bulbs and extra low voltage (ELV) non-reflector halogen lamps from 1 November 2009.
- National restrictions on ELV halogen reflector lamps from 1 October 2010.
- Sales restrictions on mains voltage non-reflector halogens and remaining reflector lamps from 1 January 2011 and October 2012.
- Operation of the Commonwealth Government's Homeowner Insulation Program (HIP) and Low Emissions Assistance Plan for Renters (LEAPR) which were implemented in response to the global financial crisis and provided subsidies for installation of insulation in Australian homes from February 2009 until their termination in February 2010.
- Compact fluorescent lights (CFLs) – non-reflector from 1 November and CFL reflector types from 1 October 2011.

Clearly, if CFLs are becoming the standard for screw in and bayonet mount residential light fittings, then a question arises over the timeframe that BAU would incorporate the use of incandescent bulbs. Following the regulatory restrictions of 1 November 2009, it would only be a matter of time until CFLs became the 'standard' globe in everyday use. Similarly, with the HIP operating through most of 2009 and the beginning of 2010, it is likely that some proportion of the ceiling insulation activity reported and 'claimed' under REES was driven by the subsidies offered by the Commonwealth scheme (where rebates in the order of $1000 to $1600 per eligible household were available).

For ceiling insulation, it is noteworthy that the HIP initiative began after the commencement of REES in 2009 and was likely to have the impact of substantially lowering the cost (per square metre) of extending this measure to South Australian homes. However, typically the subsidy did not cover the full cost and a co-payment on the part of householders was still required. HIP funding made insulation a cheaper option for achieving target abatement levels during 2009 and 2010, and the reported cost effectiveness of the scheme (in terms of dollars per abated tonne or unit of energy saving) has benefited as a result.

For CFLs, issues around additionality, and its treatment, come down to the extent that BAU adoption of CFLs in response to new government regulations has been accounted for under the deeming rates.

Analysis suggests that the deeming approach that REES applies to CFL-induced savings reasonably captures the impetus to CFL take up provided by the regulation of sales from 2009, and is generating a reasonable emission savings estimate for Stage 1. This adds weight to the evidence around the observed cost effectiveness of REES. ESCOSA has maintained close scrutiny of deeming rates and revises them periodically as required (Table 3.1).

Table 3.1 Deeming rates (t CO_2-e per installation activity) for selected items

Appliance	Code 3 (2010)	Code 4 (2012)	Code 5 (2013)
Showerhead (installed)	1.8	1.3–3.3 depending on flow rate)	1.3–3.3 depending on flow rate)
Ceiling insulation (per m^2)	0.2	0.2	0.2
Draught proofing			
per door	0.2	0.2	0.2
per window	0.03	0.02	0.02
per chimney	3.4	2.9*	2.9*
Compact fluorescent light – 880–1200 lumens, 10,000 hours life (replaces non-reflector lamp)	0.29	0.25*	0.25*
Compact fluorescent light – 1200–1600 lumens, 10,000 hours life (replaces reflector lamp)	0.66	0.89*	0.89*
Ductwork to large reverse-cycle air-conditioner	3.3	2.7	2.7

* technical specification has been refined since Code 3

Source: ESCOSA Residential Energy Efficiency Scheme Code (REESC/03/04 & /05)

3.2 Rebound

A further factor in assessing the net energy and greenhouse impact of an energy efficiency improvement scheme relates to the so-called rebound effect. This encapsulates the notion that when goods or services are cheaper, people normally buy more of them. Importantly, energy efficiency reduces the cost of energy services. More efficient lighting makes lighting cheaper, and installing insulation makes it cheaper to heat a home. In such instances, there may be some consumers that decide to run a light for longer, turn up the thermostat or heat an extra room.

However, while energy efficiency improvements continue to deliver value to energy users, some of the initial saving from the energy bill is being used to purchase more energy and the comforts that it provides. Notwithstanding these clear end-user benefits, to the extent that rebound occurs, subsequent energy and greenhouse savings can be less than those implied by the headline technical efficiency gain.

The incidence of 'rebound' has been extensively reviewed by Sorrell (2007). He highlights the variety of studies in this area and the mix of results. Transport and heating services have been extensively examined for OECD countries (albeit with a focus on the northern hemisphere), while the services delivered by other energy using appliances have had a less thorough treatment. Sorrell notes:

> For personal automotive transport, household heating and household cooling in OECD countries, the mean value of the direct rebound effect is likely to be less than 30% and may be closer to 10% for transport. Moreover, the direct rebound effect is expected to decline in the future as demand saturates and income increases. Both theoretical considerations and the available empirical evidence suggest that direct rebound effects should be smaller for other consumer energy services where energy forms a small proportion of total costs.
>
> Sorrell S (2007) 'The rebound effect – an assessment of the evidence for economy-wide energy savings from improved energy efficiency', UK Energy Research Centre, p. 39

Though he also cautions that '…Rebound effects for space heating and other energy services are also higher among low income groups'.

Studies for lighting and other household energy services are sparse, though Sorrell references some work conducted in the US which suggests direct rebound of 10% or less for lighting and approximately zero for water heating (Sorrell 2012, p. 22–23). Further, deeming rates for home insulation improvements have been explicitly adjusted under REES in recognition of the potential for rebound. Up-front estimated energy and greenhouse savings from this have been trimmed by 15% to account for the possibility of consumers boosting comfort levels (i.e. opting for more heating or cooling) in response to these services being delivered more cheaply as a result of an energy efficiency upgrade.

3.3 Savings from deferred investment

Energy efficiency schemes can also provide economic efficiency benefits by reducing demand allowing further increments to generation and transmission capacity to be deferred into the future. Where markets are working effectively and infrastructure is priced efficiently, the gain to energy consumers (in terms of lower provision costs) basically cancels out the loss to infrastructure investors (who are in the business of selling infrastructure services). However, where infrastructure is not priced efficiently and is not recovering long run costs, there will be a net economic benefit associated with deferring the next increment of infrastructure investment.

However, there is little evidence to suggest strong implicit or explicit subsidies of this nature in South Australia. A legacy of corporatisation and private ownership has driven incentives for cost recovery among utilities. Further, the proportional reduction in annual energy consumption attributable to REES Stage 1 is quite modest. Based on modelled estimates of BAU household energy consumption, we estimate that energy efficiency retrofits undertaken by REES during Stage 1 have reduced annual residential energy consumption by around 1%. This equates to a reduction in overall demand for electricity within the state of around 0.36%, and a 0.10% reduction for reticulated gas. These amounts are unlikely to have a decisive impact on the timing of infrastructure expansion decisions, particularly against the backdrop of flattened demand for grid-based electricity brought about by the uptake of renewable energy within the state.

In addition, the focus of REES Stage 1 activities in urbanised areas of the state – with rural and regional households comprising a very minor share of the REES client base – suggests that the activities funded by REES to date have made a negligible impact on the economics of energy supply in remote areas (which often receive a cross-subsidy from locations with higher population densities as part of community service obligations or through explicit price support from government). The Remote Areas Energy Supplies scheme is an example of such arrangements (Box 3.1).

Overall, consideration of extraneous factors that can impact on estimation of costs and pay-offs from the operation of REES Stage 1 over the period 2009–2011 does not substantially affect the value proposition offered by the initiative. The processes applied by REES to estimate direct energy and greenhouse savings appear robust, and these gains are not significantly diminished by consideration of second-round effects associated with the so-called rebound effect.

Even in the face of high-end rebound estimates for the energy efficiency technologies that dominated activity levels during Stage 1, REES can still be seen to be yielding a substantial pay-off to the South Australian community.

Box 3.1 South Australia's Remote Areas Energy Supplies Scheme

Homes and businesses in eligible towns across remote South Australia have access to safe and reliable electricity supplies through the Remote Areas Energy Supplies State/Independent (RAES State/Independent) scheme. Around 2600 customers in thirteen remote towns are provided with over 15 million kWh of electricity annually.

Remote Aboriginal communities of Anangu Pitjantjatjara Yankunytjatjara (APY), Aboriginal Lands Trust (ALT) and Maralinga Tjarutja (MT) are supplied with electricity through the RAES Aboriginal Communities (RAES AC) scheme. The South Australian Government sets electricity tariffs for communities supplied under the RAES State/Independent and RAES AC schemes to ensure:

- small to medium domestic customers (up to 8000 kWh per annum) continue to pay no more than 10% above the on-grid regulated standing contract tariff;
- larger domestic customers and commercial customers pay tariffs which step up towards the full cost of supply – i.e. tariffs increase as consumption increases;
- government agencies pay a tariff that reflects the average full cost of supply;
- all customers pay a fixed supply charge, similar to on-grid customers.

The South Australian Government owns the electricity infrastructure that supplies ten remote towns:

- Cockburn
- Blinman
- Glendambo
- Kingoonya
- Mannahill
- Marla
- Marree
- Nundroo
- Oodnadatta
- Parachilna.

Contractors maintain and operate the power stations and electricity distribution systems. They also provide electricity retail services to customers for all state-owned sites and those on Aboriginal lands.

Independent owner-operators supply electricity to the remaining three towns in the RAES scheme:

- Andamooka
- Coober Pedy
- Yunta.

4 REES's comparative performance

The section compares REES with other schemes operating in Australia and overseas, in order to learn from past experience and help guide the development of future REES policy development. In order to compare the schemes, a detailed review of available literature was carried out, analysing the structure of each scheme and reviewing other national and international comparative studies.

The general consensus from reviews of these schemes is overwhelmingly positive, with consistent results showing that Energy Supplier Obligations are one of the most cost-effective methods of reducing GHG emissions. There is, however, debate regarding how best to design specific elements of the schemes, such as tradability of energy certificates, targeting of low-income households, and which sectors or fuel types to target. It is generally accepted that there is no 'one size fits all' model for the schemes, but instead schemes should acknowledge local conditions, start small and grow based on tested measures.

4.1 Programs in Australia and overseas

There are many examples of Energy Efficiency Obligation (EEO) schemes that have been implemented throughout the world. Examples include:

- **Australia**
  - South Australia: Residential Energy Efficiency Scheme (REES)
  - Victoria: Victorian Energy Efficiency Target (VEET) Scheme
  - New South Wales: Energy Saving Scheme (ESS)
  - Australian Capital Territory: Energy Efficiency Improvement Scheme (EEIS).
- **Europe**
  - UK: Carbon Emissions Reduction Target (CERT) and Energy Company Obligation (ECO)
  - France: French Energy Efficiency Certificate Scheme
  - Italy: Italian Energy Efficiency Certificate Scheme
  - Denmark: Energy Efficiency Obligations
  - Belgium: Rational Use of Energy (RUE) Obligation.
- **North America**
  - United States: Schemes in California, Massachusetts, New York, Texas and several others
  - Canada: Ontario: Conservation and Demand Management (CDM) Targets.
- **Asia**
  - China: Demand Side Management Compliance Evaluation Scheme
  - Korea: Energy Utility Demand Side Management Scheme.

Although there are many similarities between each of these schemes, the design, rules, targets and implementation strategy vary for each country or state. The Regulatory Assistance Project (RAP 2012), in a report for the International Energy Agency (IEA), notes that there are three key similarities between each scheme. These include:

- a quantitative target for energy efficiency improvement;
- obligated parties that must meet the target;
- a system that defines the energy saving activities that can be implemented to meet the target; measures, verifies and reports the energy savings achieved through these activities; and confirms that the activities actually took place.

Each scheme can also be categorised into the following components:

- policy objectives
- fuel coverage
- sector and facility coverage
- performance indicators/targets
- obligated parties
- performance incentives/penalties
- eligible energy savings
- eligible energy efficiency measures
- governance, measurement, verification, reporting and compliance
- trading of energy savings
- funding.

This section looks at the design of a selection of the schemes mentioned above, and reviews any key differences with the REES scheme, highlighting specific areas of interest for that particular scheme.

4.2 Overview of comparable schemes

The development of energy supplier obligations throughout the world is a response to a widespread view that market incentives, on their own, have failed to deliver efficient levels of energy use or development and adoption of energy efficient equipment. The Stern review (Stern 2007) highlighted that energy efficiency has the biggest potential for GHG emissions savings in the energy sector, but that cost-effective opportunities were not being realised. The potential reasons for this could be:

- market failure due to information failure or split incentives (e.g. with tenant-occupied dwellings, the interests of the occupant may not align with the landlord);
- cultural and behavioural barriers, which lead to energy efficiency measures taking lower priority than other factors;
- other barriers such as capital constraints or individual perceptions of risk and uncertainty.

These issues are particularly relevant in relation to the residential and small business sectors.

The Oakley Greenwood report assessing Australian Energy Efficiency Policies and Programs notes that the cost savings for the schemes come from three main sources:

1. Reduction in operating costs, based on fuel saved
2. Reduction in additional carbon tax, also linked to fuel saved
3. Fixed costs from a reduction in the need for new supply capacity.

The first two will only apply to those that participate directly in the schemes, whereas the fixed costs will provide reductions to all customers through reduced capital expenditure by energy companies.

4.2.1 Australia: Victorian Energy Efficiency Target (VEET) and NSW Energy Savings Scheme (ESS)

The VEET and ESS schemes were both established in 2009, and with a few minor differences in fuel and sector coverage, follow a very similar design (Table 4.1). Unlike the REES scheme, both allow trading of certificates, and these 'credits' can be a useful source of 'top up' funding for approved energy efficiency projects.

Table 4.1 Comparison of VEET and ESS schemes

Measure	VEET (Vic. Australia)	ESS (NSW, Australia)
Period	2009–2012 2012–2015	2011 2012
Policy objectives	Reduce GHG emissions; encourage the efficient use of electricity and gas; encourage investment, employment, and technology development in energy services.	Reduce electricity consumption and costs; complement a national emissions trading scheme; reduce cost of additional generation and network capacity.
Fuel coverage	Electricity and gas	Electricity only
Sector and facility coverage	Residential and business	Residential, commercial and industrial
Performance indicators	2009–2012: 2.7 million VEECs p.a. (2.7 Mt CO_2-e reduction) 2012–2015: 5.4 m VEECs p.a. (5.4 Mt CO_2-e reduction)	2011: 2% of annual NSW electricity sales (2.5% of annual liable electricity sales) 2012: 2.8% of annual NSW electricity sales (3.5% of annual liable electricity sales)
Obligated parties	Gas and/or electricity suppliers with 5000 or more customers	All holders of electricity retail licences in NSW, plus other electricity generators
Performance incentives / penalties	Penalties for each certificate not submitted ($40 per certificate for the 2010 compliance year, $42.73 per certificate for the 2012 compliance year)	Shortfall penalty rate is $24.8 per certificate

Measure	VEET (Vic. Australia)	ESS (NSW, Australia)
Eligible energy savings, including peak reduction	Overall energy reductions are counted, no mention of peak reduction or distribution of energy	Overall energy reductions are counted, no mention of peak reduction or distribution of energy
Eligible energy efficiency measures	A range of prescribed activities, split into 15 broad categories	Energy savings from pre-approved energy efficiency projects; accredited non-obligated parties may implement projects
Measurement, verification, reporting and compliance	Essential Services Commission responsible for auditing Relevant Entities and Accredited Persons	IPART is the Scheme Regulator, and require random audits
Trading of energy savings	Yes	Yes
Funding	Obligated parties' costs are treated as a cost of doing business	Obligated parties' costs are treated as a cost of doing business
Cost benefit to society	VEET RIS estimates net benefit of $1.42 billion to 2021 (a benefit-cost ratio of 1.6)	Overall benefit estimated at $24.56 per Energy Saving Certificate.

Cost effectiveness

Both schemes function through the creation of certificates, with each certificate worth 1 t CO_2-e abated. In Victoria, they are known as Victorian Energy Efficiency Certificates or VEECs, and in NSW they are called Energy Savings Certificates (or ESCs). Both schemes prescribe the type of measures that can be used for certificate creation and, in December 2011, the NSW and Victorian Premiers announced an agreement to pursue increased consistency between the two schemes. The harmonisation of the schemes should help to reduce costs involved in compliance for larger energy retailers that function in multiple states, and has the potential to broaden the range of acceptable activities for creating certificates in both states. However, to date there does not appear to be much progress in this direction – due, at least in part, to intersecting policy discussions around a national energy efficiency initiative.

In 2011, the target for the NSW ESS was 2% of electricity sales, which equates to 1,086,120 certificates (Databuild 2011), whereas the Victorian VEEC target for the same year was 2,700,000 (VEET website 2013), which is substantially more than the NSW and REES targets, and has increased to 5.4 million VEECs in 2012, whereas NSW has only increased to 2.8% of electricity sales.

Both schemes showed overall positive net benefits. The VEET program showed an overall net benefit of $323.3 million in 2012 (representing a total cost of $125.3 million and benefit of $448.6 million). ESS for the same period showed an overall net benefit of $84.2 million (a total cost of $24.8 million and benefit of $109.0 million) (Oakley Greenwood 2012).

Customer engagement and information accessibility

Unlike REES, there is no audit requirement for the ESS or VEET schemes, which reduces the provision of direct household-specific information to customers as an element of the scheme. The ESS publishes 'case studies' highlighting measures that have been successfully implemented, which can help reduce the information gap. Information can enhance the ability of consumers to make informed decisions about the quantity and timing of their electricity use, and help drive behaviour change. However, it can be a challenge for 'information based' initiatives to make a lasting difference. The challenge here is affect the energy use 'culture' or 'paradigm' by achieving a lasting change in awareness and attitude to energy savings potential.

Stakeholder engagement

The Department of Climate Change and Energy Efficiency (DCCEE) and the Department of Resources, Energy and Tourism (DRET) produced a progress report for the National Energy Savings Initiative (DCCEE & DRET 2012). As part of the report, a number of stakeholders provided feedback on each of the schemes operating in Australia. Their comments fell into two categories, namely:

- **Inconsistencies between schemes, leading to inefficiencies or inconvenience**
  - The Energy Efficiency Council stated that multiple state schemes lead to duplication, inefficiencies and higher costs. They stated that a national scheme would provide economies of scale, a greater variety of energy saving measures, reduced administrative costs and reduced red tape for consumers.
  - The Refrigerated Warehouse and Transport Association of Australia commented that certain measures are allowable in some states and not in others, restricting the available savings, and hindering companies that work across different states.
- **Preferred features for inclusion in a national scheme**
  - Retention of tradable certificates in both VEET and ESS.
  - Retaining flexibility in measuring and awarding energy efficiency.

4.2.2 United Kingdom: Carbon Emission Reduction Target (CERT)

The UK scheme was first established in 1994, covering both gas and electricity use in the domestic sector (Table 4.2).

Supplier obligation schemes

As the longest running scheme of its kind in the world, CERT provides a wealth of research on the evolution of the obligations and the cost effectiveness of different measures that have been implemented throughout the years. In 2005, OFGEM (the UK regulator for the scheme) noted that supplier obligations were the most important instrument for delivering energy and carbon savings in the domestic sector. Businesses and industrial end-users are not covered by the scheme as they are targeted through other policy instruments. Targets are set by the Department of Energy and Climate Change (DECC) for each obligation period. The targets are established in comparison to a baseline, and therefore an overall energy reduction is not required. The savings for each installed measure is also based on lifetime energy saved.

Table 4.2 CERT Scheme and ECO

Measure	CERT (UK)
Period	CERT: 2008–2012 ECO: 2013–2015
Policy objectives	CERT ECO
Fuel coverage	Electricity and gas
Sector and facility coverage	Domestic customers
Performance indicators	CERT: CO_2-e reduction target: 293 Mt CO_2-e (lifetime) over 4 years (~104 TWh p.a.) / 40% of savings met in priority group ECO: Carbon and cost savings of 20.9 Mt CO_2-e for CERO, 6.8 Mt CO_2-e for CSCO, and £4.2 billion under the HHCRO*
Obligated parties	CERT: All suppliers with over 250,000 gas and/or electricity domestic customers ECO: All suppliers with over 250,000 domestic customers, supplying over 400 GWh of electricity or 2,000 GWh of gas
Performance incentives/penalties	Penalties for failing to meet requirement, up to 10% of global turnover
Eligible energy savings, including peak reduction	Overall energy reductions are counted, no mention of peak reduction or distribution of energy
Eligible energy efficiency measures	CERT: Minimum levels for some measures (68% from insulation), otherwise not prescribed ECO: A list of eligible measures, including insulation, heating and micro-generation has been published by OFGEM, but other measures could be used, at OFGEM'S discretion
Measurement, verification, reporting and compliance	OFGEM is responsible for administering and enforcing the supplier obligations
Trading of energy savings	Yes (in the form of agreed transfers of excess compliance units between obligated parties)
Funding	Costs are considered 'part of doing business' and are hence recovered through prices charged to end-use customers
Cost to suppliers of achieving targets	Estimated cost from April 2008 – December 2012 is £5.5 billion
Cost benefit to society, in net present value	Estimated NPV of £17 billion
Estimated annual spend (as of 2008 or 2011), according to ECEEE report	€900 million (€15 per person or €4 per t CO_2-e based on 293 Mt CO_2-e)

* CERO: Carbon Emissions Reduction Obligation
CSCO: Carbon Saving Community Obligation
HHCRO: Home Heating Cost Reduction Obligation

Since the first scheme (Energy Efficiency Standards of Performance, 1994–1998), the targets have increased significantly, from 6 TWh between 1994–1998 to over 400 TWh for the CERT scheme between 2008–2012. This increase in obligation target has had an inevitable knock-on effect on the cost of the schemes, from £25 million per year in 1994 to £1.2 billion per year in 2012.

That is a 48-fold increase in costs over 18 years, and reflects the combined impact of scheme expansion, deepening targets and the need to access higher cost technologies and activities to deliver on those targets.

These costs have been passed on to energy customers through increased energy prices, with some additional customer contribution for certain measures. It has been estimated that the average household bill was increased by £1 per year between 1994–98, but by more than £50 per year between 2008–2012, with approximately 39% of households in the UK benefitting directly from the measures supported by CERT. The net benefit of the scheme has been estimated at £17 billion. The penalty to suppliers for not meeting their target is said to be up to 10% of the supplier's turnover, but there have been no instances of obligations not being met since the start of the scheme.

Other notable changes that have occurred over time include:

- **SOCIAL EQUITY**: Specific targets for disadvantaged customers were introduced in 2002, with a target of 50% of savings to be made for this group. In 2008 under CERT, this target was reduced to 40%. The current ECO scheme further expands the targets for priority groups, including 15% for energy efficiency measures in low income homes, 25% for home heating measures to the most vulnerable homes and an emphasis on harder to treat homes for the overall target.
- **TRADING**: Trading was introduced in 2002, allowing certificates to be traded between suppliers once targets are met. However, very few suppliers have engaged in this activity.
- **MEASURES**: Eligible measures were increased to allow micro-renewables in more recent versions, and minimum quotas were imposed, such as 68% of the CERT target being met through insulation measures.

The UK schemes have shown that it was mainly gradual processes that have driven the changes in the schemes over time, rather than triggers such as crisis events, as is often perceived (Rosenow 2012). There has also been a recent development where some energy suppliers have established heating companies, insulation subsidiaries and renewable micro-generation companies (Lees 2012). However, the scheme has had to deal with growing concerns about the escalation of costs as low cost energy efficiency measures and progressively exhausted.

Stakeholder engagement

In a stakeholder workshop review of European EEO schemes, British Gas New Energy noted that it was the long-term nature of the UK scheme that helped create a stable policy environment, and encouraged investment in new areas. This helped lead to rapid growth of their energy efficiency and small-scale renewable energy business, and also helped investment in new measures and technologies. They also noted that forcing a particular efficiency measure can reduce the cost effectiveness of the scheme. The UK energy providers have developed partnerships or created new departments within their own business to create efficiencies in delivering energy efficiency, and there has been a shift towards provision of energy services, rather than pure energy supply.

4.2.3 France: Energy Efficiency Certificate Scheme

The French EEO scheme was established in 2006, and covers a large number of sectors and fuel types (Table 4.3).

Table 4.3 Energy Efficiency Certificate Scheme

Measure	EECS (France)
Period	2006–2009 2011–2013
Scheme name	French Energy Efficiency Certificate Scheme
Policy objectives	To realise the available potential of energy efficiency in France
Fuel coverage	All fuels, including district heating and cooling, and transport fuels
Sector and facility coverage	2006–2009: All (including transport), except EU ETS 2011–2013: Residential and commercial buildings, manufacturing industries, transport and agriculture
Performance indicators	2006–2009: 54 TWh over 3 years 2011–2013: 345 TWh (255 TWh for electricity, gas, heating, LPG, plus 90 TWh cumac for transport fuels)
Obligated parties	Energy retailers that sell the covered fuels to end-consumers, plus automobile wholesale fuel suppliers that reach the thresholds
Performance incentives/penalties	Penalty of €0.02/kWh lifetime final energy shortfall
Eligible energy savings, including peak reduction	Deemed savings from measures can be produced by obligated parties, local authorities and social housing landlords
Eligible energy efficiency measures	Standardised and non-standardised measures, plus contributions to programs targeting fuel poverty, education, or innovation
Measurement, verification, reporting and compliance	The government, with ADEME (French environment and energy and management agency) set targets
Trading of energy savings	Yes, through certificates
Funding	Cost recovery through tariffs is possible, but has yet to be allowed
Cost effectiveness of scheme	€2.14 return for every €1 spent for first obligation period
Estimated annual spend (as of 2008 or 2011), according to ECEEE report	€180 million (€3 per person)
Nature of saving target	Lifetime delivered energy

* cumac: cumulative and discounted

With regard to sector coverage, the French scheme covers a far wider range than other schemes, including:

- Residential
- Commercial
- Manufacturing industries (only those not covered by the EU Emissions Trading Scheme)
- Networked industries
- Transport
- Agriculture.

The scheme also allows certificates to be created through measures such as information programs, training, innovation and others, providing greater flexibility for how and where savings are made. However, for the first reporting period between 2006 and 2009, the majority of savings (83%) were made within the residential sector, with only 6% through commercial buildings, 8% in industrial buildings and 0.3% in the transport sector. For the current obligation period, a specific target has been included for the transport sector of 90 TWh, which is the first target of this nature to be implemented in any of the international schemes. The results of this have not yet been published, but it will be interesting to see whether the EEO scheme can successfully create cost-effective savings in the transport sector.

One criticism of the scheme has been made regarding doubling up on initiatives for particular measures. In the first reporting period, 72% of certificates were issued in the heating sector, but as there were already tax incentives for these measures, there is some controversy surrounding the 'additionality' of these reported savings.

4.2.4 USA: California Energy Efficiency Certificate Scheme

California has been at the forefront of energy efficiency in the United States The Californian EEO scheme was established in 2005. In the same year the state government issued an executive order to reduce GHG emissions to year 2000 levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050 (Table 4.4).

The California Public Utilities Commission established the Long-Term Energy Efficiency Strategic Plan, outlining a vision for market transformation with four key strategies (RAP 2012; California Public Utilities Commission 2008):

- All new residential construction in California will be zero net energy by 2020.
- All new commercial construction in California will be zero net energy by 2030.
- Heating, ventilation, and air-conditioning will be transformed to ensure that its energy performance is optimal for California's climate.
- All eligible low-income customers will be given the opportunity to participate in the low-income energy efficiency program by 2020.

For the obligation period between 2006 and 2008, it has been estimated that for every dollar spent by investor-owned utility companies on energy efficiency measures, US$1.17 was received in benefits by the state. This figure is considerably lower than some of the other international examples, but still shows a positive result.

Table 4.4 California Energy Efficiency Certificate Scheme

Measure	CEECS (California, USA)
Period	2010–2012
Scheme name	California Energy Efficiency Certificate Scheme
Policy objectives	Obtain 100% of cost-effective energy efficiency and reduce total consumption by 10% within 10 years
Fuel coverage	Electricity and natural gas
Sector and facility coverage	New construction; heating, ventilation, and air-conditioning; and low-income customers
Performance indicators	6965 GWh (0.9% of sales), 1537 MW and 150 million therms in 2010–2012 for investor-owned utilities; 700,000 MWh for publicly owned utilities
Obligated parties	Investor-owned and publicly owned electricity and natural gas utilities
Performance incentives/penalties	Penalties apply to those who achieve below 65% of target, incentives apply to those achieving over 80% of target, capped at US$450 million
Eligible energy savings, including peak reduction	Energy efficiency savings implemented by the utilities themselves or by contractors
Eligible energy efficiency measures	Measures include 12 statewide energy efficiency programs
Measurement, verification, reporting and compliance	California Public Utilities Commission developed verification protocols. They carry out rigorous audits for programs. Utilities companies implement approved programs and report to the relevant agency, the California Energy Commission.
Trading of energy savings	No trading is allowed
Funding	Funding through increased customer charges, capped at 3% of a customer's bill. Additional funding through utility resource procurement budgets.

4.2.5 China: Demand-Side Management Compliance Evaluation Scheme

Specific emissions reduction targets for Chinese utilities companies were introduced in 2011 adding to the previously established demand-side management policy for energy efficiency. Owing to the population diversity and state of development of the country, it will be interesting to see how successful this new scheme proves to be (Table 4.5).

Demand-Side Management (DSM) was introduced in China during the 1990s, and has been a powerful instrument for reducing energy demand and peak loads. However, much of China's past efforts have been 'command and control' or 'directed' action, and many outcomes have come at high cost. In November 2010, China issued a DSM Implementation Measures guidance document, which placed targets on grid companies to reduce total energy sales and peak demand.

The scheme was started in 2011, but the general design of the scheme has yet to be fully tested. A review of the scheme was carried out in 2012 by RAP to help guide the development of the scheme, and they provided several recommendations based on past international experience and an understanding for the local market. The recommendations were as follows:

- Each grid company should submit regular DSM plans outlining their proposed activities for reaching their targets, along with expected costs for implementation.
- Grid companies should submit regular performance reports detailing actual results from each program, including achieved savings, costs incurred.
- Grid companies should submit details of methods used to calculate savings.
- Government should establish processes to carry out random, independent audits of grid companies.
- Ensure that demand-side investment is prioritised over supply-side by providing independent cost-effectiveness analyses of DSM programs.
- Help develop mechanisms to align grid company incentives with China's DSM goals.

Table 4.5 Demand-Side Management Compliance Evaluation Scheme

Measure	DSM Compliance Evaluation Scheme (China)
Period	2011–2015
Scheme name	Demand Side Management Compliance Evaluation Scheme
Policy objectives	To prioritise DSM in tight supply situations
Fuel coverage	Electricity
Sector and facility coverage	All economic sectors and any facility including transmission and distribution networks
Performance indicators	0.3% reduction in electricity sales ad 0.3% of maximum load from the previous year
Obligated parties	Government-owned grid companies
Performance incentives/penalties	No penalty, incentives available pending a result of 'excellent' (90 points +); no further details available
Eligible energy savings, including peak reduction	Energy reductions and peak reduction

Measure	DSM Compliance Evaluation Scheme (China)
Eligible energy efficiency measures	To be developed by each province
Measurement, verification, reporting and compliance	Government agency responsible for compliance and target setting. 100% of savings can only be claimed if audited by third party or recorded by equipment.
Trading of energy savings	Obligated parties may purchase savings from customers and ESCOs under bilateral contracts
Funding	Funding is through either: ▪ a utility surcharge collected through tariffs; or ▪ through other methods such as energy saving and emission reduction funds from central or provincial governments.

4.3 Implications for the comparative costs and performance of REES

An overview of energy efficiency retailer obligation schemes beyond REES suggests that the South Australian scheme is one of many, shares many features with other Australian and offshore schemes and, to date, has not set overly ambitious abatement (and energy savings) targets. REES has started slowly, applying a relatively simple design. While its requirement to prioritise energy savings among low income households is less common among schemes of this type, it is not unique – and there are legitimate efficiency and welfare arguments for promulgating this requirement. However, the requirement to undertake household audits within this group does appear to represent an innovative design feature.

Beyond a comparison of scheme design, consideration of relative performance becomes difficult – particularly where offshore jurisdictions are involved and it is necessary to take account of (potentially) large differences in energy and technology prices, climate, energy usage patterns and regulatory regimes. However, a focus on the major Australian systems (i.e. REES, ESS and VEET) is illuminating (the ACT system has only just begun and has yet to establish a track record).

As highlighted above, the targets of all schemes differ in their savings ambition, and also in their sectoral coverage. This implies a need for caution in comparing performance, but some broad observations can be made. Table 4.6 provides a comparative overview of key performance outcomes for REES, ESS and VEET. It draws on the published reports of NSW IPART (2012) and the Victorian Essential Services Commission who administer these schemes. BAU deviation estimates are derived from the in-house modelling conducted for this project. Note that for energy and savings estimates different deeming approaches and time horizons (for summing anticipated savings) can apply. This is particularly relevant for the NSW ESS scheme.

These numbers suggest significant variation in administrative costs per unit of abatement for the schemes, and a pattern of higher unit costs for REES. However, the significant differences in scale across the schemes in terms of the energy and emissions base and the level of savings targeted can be important to this result. Bigger schemes can generally achieve lower unit costs due to economies of scale – that is, the ability to spread fixed costs over a broader participant base and add extra participants and abatement relatively cheaply. The fact that the savings figures above omit the value of energy savings achieved in each jurisdiction is also pertinent. Importantly, the benefit-cost ratios reported pick up this factor. These suggest the strongly beneficial nature of REES and its comparability with Victoria's VEET scheme in this regard.

Table 4.6 A key parameter comparison of REES, ESS and VEET

	REES (2009–2011)	ESS (2011)	VEET (2011–2012)
Target deviation from sectoral BAU trajectory	1.21% (GHG saving)	2.5% (energy saving)	–
Energy saving (with deeming)	4.11 PJ (1,141,666.7 MWh)	2.96 PJ (823,224 MWh)	14.4 PJ (4,000,000 MWh)
Estimated GHG saving/credits created (t CO_2-e)	644,900	872,617	4,400,000
Estimated participant cost (A$)	27,308,000	$12,348,360	$48,400,00
Administrative cost (A$)	$1,792,000	$2,100,000	$5,310,000
Administrative cost per 'credited' CO_2-e tonne	$2.73	$2.41	$1.21
NPV benefit (A$)	$101.7m	$84.2m	$323.3m
Benefit-cost ratio	3.5	2.0	3.6

Notes: For ESS, reflects an 80% share of total administrative costs for ESS and Greenhouse Gas Reduction Scheme (GGAS); total net benefit of $24.56 per ESS certificate; participant costs estimated at half the 2011 average spot price (i.e. $30); and an ESS certificate conversion factor (for CO_2-e emissions) of 1.06 kg CO_2-e per kWh. For VEET, reflects an estimated average Victorian Energy Efficiency Certificate (VEEC) price for 2011–2012 of $22 and a CO_2-e conversion rate of 1.1 kg CO_2-e per kWh.

Sources: IPART (2012), Compliance and Operation of the NSW Energy Savings Scheme during 2011, July 2012, Esc (Victoria) (2012), Annual Report, ESCOSA (2012), Residential Energy Efficiency Scheme Annual Report (June).

5 Stakeholder feedback on REES

Over the course of the last four years, REES has touched a great many South Australian households. At the end of Stage 1 (2009–2011), REES had carried out appliance upgrades in over 164,000 residences and undertaken energy audits in more than 9240 low income homes. A measure of success of the program is the extent to which householders have perceived a benefit from its operation, and carry forward an enhanced awareness of energy efficiency opportunities. Those with an exposure to REES can also provide useful insights to opportunities for enhancing its effectiveness in the future.

Stakeholder views on the operation and performance of REES have been an important source for this evaluation. An overview of comments and key themes is reported below. The outcomes draw on:

- submissions to the DMITRE issues paper
- interviews with businesses and other agencies that deliver REES or have a stake in its impact
- interviews with a significant sample of households that have participated in REES.

5.1 Stakeholder submissions

In October 2012, DMITRE released an Issues Paper seeking stakeholder feedback on the performance and potential of REES. The paper received eleven written responses that are published on the Government's website.

Summaries of the responses can be found in Appendix 1 of this report and, in some cases, detail is provided where new ideas were provided. We have provided consultant comments in square brackets.

Key messages from the contributed papers include the following.

- Major retailers were generally comfortable with the scheme as currently structured, and recognised that administration of REES by ESCOSA has been effective and efficient. Nevertheless, all retailers were clear that they did not wish REES to continue beyond 2014. Should REES continue, or be replaced by a similar national scheme (NESI), tradable certificates was considered essential. The case for a market-oriented approach to certificates and service providers was made strongly by Simply Energy which raised doubts about the relevance and efficacy of the scheme in the face of carbon pricing and potentially more effective ways of achieving REES energy efficiency and welfare goals.
- While recognising the reason for the role of a priority target group in REES, the retailers were at best ambivalent toward it, suggesting a greater role for retailers to identify needy households. All retailers were concerned that the low-cost REES options were rapidly reaching saturation. Retailers noted the audit target did not value potential behavioural changes delivered, though consumer views suggested the audits were too shallow for a meaningful benefit. There was recognition that more detailed audits, with follow up to support behavioural change could lead to better demand responses enabled by smart meters, the internet and in-home displays (IHDs).

- Consumer and business groups identified concerns in relation to the target group, under-representation of regional and remote households, and poor audit processes. The not-for-profit service providers felt that REES for the priority group could be delivered more effectively through them in conjunction with the wide variety of safety net services already provided, including through Commonwealth and South Australian government programs – the failure of coordination on such support activities was noted.
- All stakeholders indicated that more communication activities were needed to better promote awareness of REES, particularly in making clear the government policy role.

These points were examined in greater detail in stakeholder interviews undertaken as part of the current review.

5.2 Interviews with community groups and service providers

Interviews were conducted with several key stakeholders encompassing obligated energy retailers, service and equipment providers and community and consumer groups. While individual comments cannot be attributed, the diversity of views (and those items of feedback that emerged as consistent themes) are discussed below.

5.2.1 Energy retailers

Perceptions of REES vary significantly within the group of energy retailers obliged to deliver the scheme to South Australia's residential customers. Some accept the scheme as an extension of their 'social licence to operate' and have plans to incorporate these obligations within a broader commercial offering that actively promotes energy efficiency services and community values.

Others perceive REES as being an unwelcome and unnecessary impost on their business with little role for driving energy efficiency improvements in the stationary energy sector in the face of a substantive carbon price. They suggest that the carbon price and growing energy consciousness are structural drivers of household energy efficiency improvement, and that the rationale for government intervention to address an energy efficiency 'gap' has been seriously eroded by these factors. They suggest that REES is increasingly a transfer from them to households, and ultimately a cross-subsidy from general energy users to those households in the priority group.

For these retailers, REES has outlived its usefulness as an instrument for promoting more efficient resource outcomes; and the benefits it delivers to low income households could be delivered more effectively via other means.

Retailers highlighted the role of carbon pricing in making greenhouse costs and objectives explicit in ongoing efforts by policymakers to encourage emission reductions. However, when asked if carbon pricing, and in particular the publicity that plans for carbon pricing had attracted in the lead-up to its implementation in July 2012, had resulted in a major new interest in energy efficiency measures among customers (and an anticipatory drop in consumption) they indicated that they had been able to discern little impact.

In terms of the design and administration of the Scheme, most retailers viewed it as well run (one praised ESCOSA's 'excellent' administration of the Scheme) and easy to navigate from an administrative and compliance perspective. REES reporting obligations were not considered onerous and added little to the established 'back office' workload for energy companies that already had established obligations under energy efficiency schemes operating in Victoria and NSW.

However, retailers saw some merit in moving toward an approach that allowed compliance via certificate purchases from a tradable abatement credit pool, rather than requiring retailers to negotiate individual contracts with energy efficiency service providers and face a subsequent requirement to demonstrate the bona fides of their claims against target abatement levels. The need to enter these negotiations (and compare and contrast different quotes and service offerings was highlighted as a particular impost on smaller retailers entering the REES scheme. For small retailers whose growth had caused them to trigger the REES obligation threshold, the costs of provider negotiations and legal work need to be fully covered even though the amount of abatement being purchased was relatively small. This would tend to drive up the average cost per tonne of abatement under REES for these firms (relative to retailers with a bigger residential customer base in South Australia) and may also make them unattractive clients for service providers who, like many businesses, could be expected to give priority to bigger customers and projects. A paucity of service providers and lack of transparency around the current and expected cost of service delivery is seen as an issue by these retailers.

As a summary measure, retailers were asked to rate REES' design and effectiveness on a scale of 1 to 10 (10 being 'excellent'). Ratings fell in a range from 2 to 7.

5.2.2 Energy efficiency service and equipment providers

The evaluation team spoke to a major energy efficiency service provider, and an equipment provider under REES. These stakeholders saw REES in a positive light and supported its extension and expansion, although they noted the saturation of low outlay / high savings retrofit opportunities under the scheme and the prospect of increasing costs into the future. For service providers, finding households that have yet to switch to CFLs is becoming harder and harder and the availability of this 'low hanging fruit' – and cheap source of abatement for REES compliance purposes – is diminishing rapidly. The need to source at least 35% of abatement from priority group households adds an extra challenge to the task of rolling out technology and audits in line with REES objectives, and at the lowest cost possible. As one stakeholder put it 'Giving away free stuff is not always as easy as you'd think!'. Few households approached service providers directly to access REES benefits. The great majority of households were accessed by going door-to-door or through referral from retailers or community groups. The latter were a key source of priority group households.

The next tier of low cost and 'neglected' energy efficiency devices – some of which were already registering strongly in the mix of REES compliant activities – included standby power controllers, LED extra low voltage down lamps lighting upgrades and chimney plugs. Service providers also noted the potential to target more households in rural and regional areas (particularly as a source of priority group households), but highlighted the higher costs associated with servicing these areas (due to travel, accommodation, logistics, etc). City suburban areas offered higher population densities and greater proximity to head office and the installers and auditors themselves. Some recruitment was occurring in the regions (the Barossa Valley and Whyalla were cited as examples), but pushing services beyond Adelaide and its surrounds was generally seen as offering little in terms of delivering REES abatement targets at least cost.

On the question of how REES compared with the Victorian or New South Wales retail energy efficiency schemes, there was a view that it represented a more 'orderly' arrangement for generating abatement and linking obligated retailers to abatement providers, and was better suited to the smaller market of South Australia. Though the service provider market in South Australia was less competitive, this was seen as a virtue – it avoided duplication of supplier businesses (with inevitable failures) and 'cut throat' competition which (based on experience under VEET) had amplified incentives to reduce quality and 'cheat' on retrofit and reporting requirements.

In terms of potential improvements to REES design, this group saw merit in extending the targets and eligibility criteria to drive more rapid take-up of energy efficient technology in the commercial sector. Satisfaction with REES overall design and effectiveness was high within this group, with a consistent rating of 8 out of 10 being reported.

5.2.3 Welfare and consumer groups

Several South Australian-based welfare agencies and a consumer group representative agreed to give their views on REES. Some provided input as referrers of priority group clients to REES and all agencies had a strong interest in the effectiveness of REES in assisting poor and disadvantaged households within the State.

All these agencies supported the priority group targets within REES, but there was a view among many that REES could do more to assist those most in need:

- some types of household that were struggling financially did not fall within the current priority group definitions;
- to date, rural and regional households had been largely neglected by REES;
- REES did not prioritise those in need within the priority group.

These agencies were also slightly critical of the 'mechanical' nature of the scheme delivery which tended to focus on installing energy efficient equipment in qualifying households in the shortest time possible. The emphasis was clearly on equipment penetration rather than achieving attitudinal change or an understanding of the prospective economic benefits of improved energy efficiency within households. The lack of an educational emphasis was seen by many as a missed opportunity on the part of REES.

Dissatisfaction with the interpersonal dimension of REES service delivery also extended to the household energy audit activities. While some respondents were aware of some excellent audits being carried out, where energy assessments were both thorough and effectively communicated to householders, many were considered to be very cursory, involving a quick walk-through and little engagement with the occupants. For some respondents, there was little to separate the activities delivered as an energy audit from those undertaken for the purposes of appliance retrofit. The commercial realities of cost and time pressure were seen to be driving this outcome, and it raised concerns about the quality of the energy audit activities in particular.

Several respondents contrasted the audit activity undertaken in the context of REES under commercial subcontractor arrangements with those sponsored by the Commonwealth Government's Home Energy Saver Scheme (HESS). This program funded through the Department of Families, Housing, Community Services and Indigenous Affairs (Facia) was implemented to provide low income households one-on-one advice and support in anticipation of energy cost increases brought about by action to cut GHG emissions. Under HESS, welfare groups provided the interface with households and led the conversation on energy saving behaviours and measures (Box 5.1).

There was some interest among welfare groups in helping REES to prioritise the most needy households among eligible priority group clients. It was suggested that it might take the form of targeted referrals or a higher weighting being applied to energy savings achieved within this group. Welfare groups felt they were well placed to rank households on the basis on need, and spoke of groups such as the 'working poor' who could often be among the most needy, but fall outside the current priority group definitions.

Box 5.1 **FaHCSIA's Household Energy Saving Scheme (HESS)**

The Home Energy Saver Scheme is part of the Australian Government's 'Securing a Clean Energy Future' climate change plan and was developed in the context of the expansion of the Low Carbon Communities Program.

HESS has been allocated $50.5 million in Commonwealth funding over four years (until 2014–2015) and is available nationally. It is aimed at supporting low-income households experiencing difficulty in paying for their energy bills.

HESS is provided through community organisations around Australia and offers needy households:

- information about easy and affordable ways to use less energy in the home;
- one-on-one budgeting assistance;
- information on whether households are getting the right rebates and assistance;
- help to understand energy bills and the energy market;
- advice, advocacy and support;
- advice on to other assistance services that may be able;
- access to no or low interest loans to purchase energy efficient appliances.

In South Australia HESS is being implemented by Uniting Communities (Adelaide and Christies Beach) and Uniting Care Wesley Country South Australia.

Source: Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs (Facia)

5.3 Household survey

As part of this review, and with the support of DMITRE and ESCOSA, we were able to access contact information and service details for a range of South Australian households who had participated in REES in the previous 18 months. Those who had been exposed to the appliance retrofit activities of the program and those exposed to energy audits were of particular interest – and the population was segmented on that basis.

Telephone surveys of these groups were conducted, with the following responses recorded:

- Non-priority group participants (retrofits only) – 270 responses
- Priority group participants (retrofits and audits) – 269 responses.

These sample sizes are likely to provide a statistically significant representation of the underlying population consistent with a confidence level of 90% or more. In short, the results from these samples can provide a very reliable picture of the client performance of REES – recognising that the results presented below entirely reflect householder perceptions and recollections of the devices and services provided.

In general, REES has been very well received by South Australian householders and there is a high degree of satisfaction with both the retrofit and audit services provided. Importantly, there are also indications that REES is successfully accelerating the take-up of the appliances across these homes and positively affecting attitudes to energy saving and savings potential. This represents a positive 'multiplier' effect from the scheme.

Key questions, responses and comments follow. The full list of questions fielded in the telephone survey are reproduced in Appendix 2.

5.3.1 Retrofit activities

Retrofit activities were provided to around 140,000 households (including priority group and non-priority group households) in the 18 months prior to February 2013. Responses from 539 households underpin the following results.

In the main, the quality of the retrofit services delivered under REES are well regarded with around 90% of appliances individually installed (as required) - with a slightly greater incidence among members of the priority group (e.g. pension and health concession card holders). Only 6% said that appliances were left for them to install themselves (incorporating 1% of priority group responses).

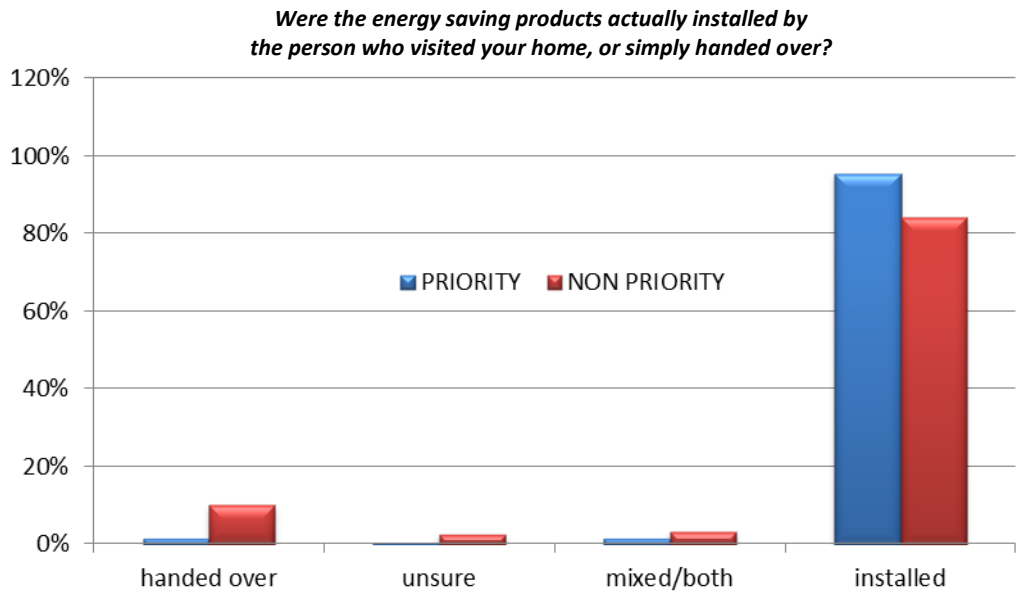


Figure 5.1

REES survey result: Installation of energy saving products

Importantly, 95% of respondents said they were either happy or very happy with the quality of the job.

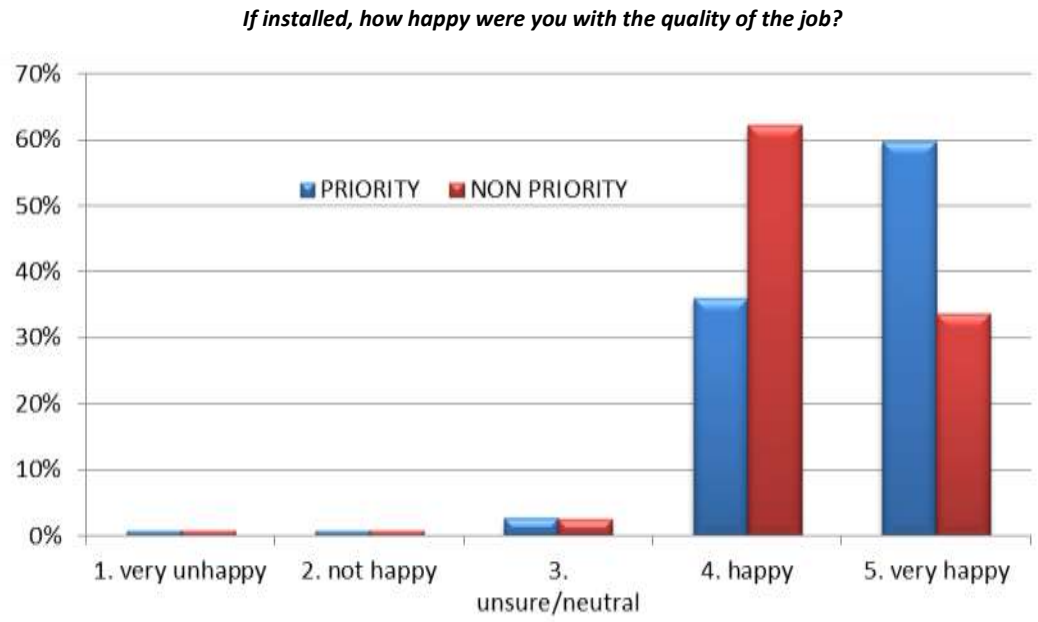


Figure 5.2

REES survey result: Satisfaction with appliance installation

CFLs, low-flow showerheads and standby power controllers (for audio visual or information technology use) dominate the recent appliance roll out under REES. Survey questions focused on the incidence and experience with these products. Most respondents said that they would have been unlikely to purchase these appliances themselves within the next six months of the REES visit. Priority group members were particularly unlikely to make these purchases as part of BAU.

- 28% of the priority group considered it 'very unlikely' they would have made these purchases;
- 31% of the priority group considered it 'unlikely' they would have made these purchases;
- comparable figures for non–priority group households were 19% (very unlikely) and (30% likely);
- overall, only 20% of priority group representatives stated that they would be likely or very likely to have made these purchases, versus 37% for the non–priority group.

The respondents also indicated that the installed devices tended to be used in high-use applications (suggesting a high level of savings were being generated) and were delivering a high level of performance.

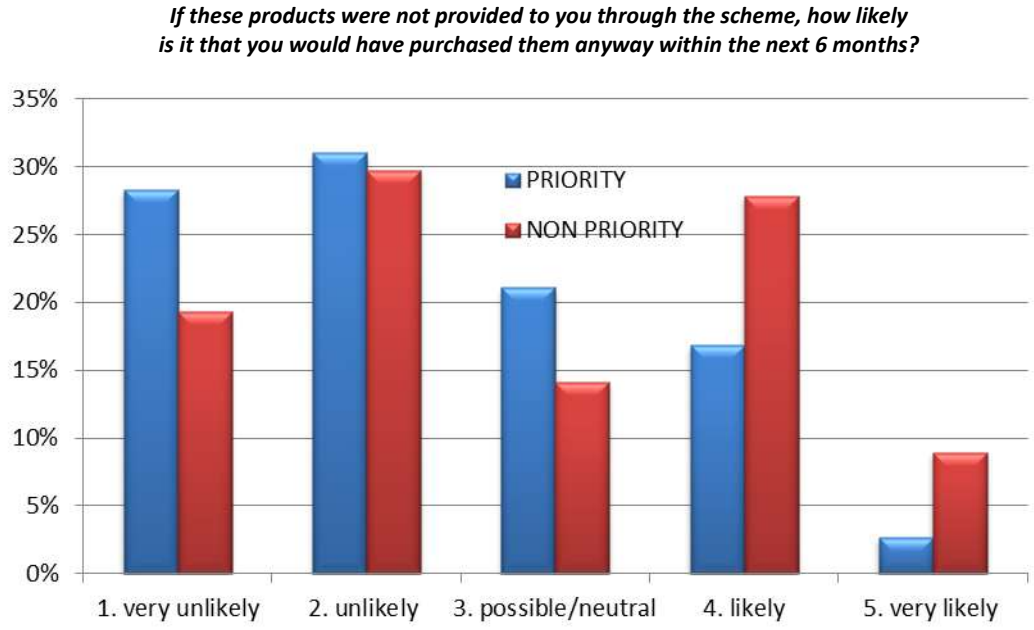


Figure 5.3

REES survey result: Accelerated diffusion of energy saving appliances

Compact fluorescent lamps

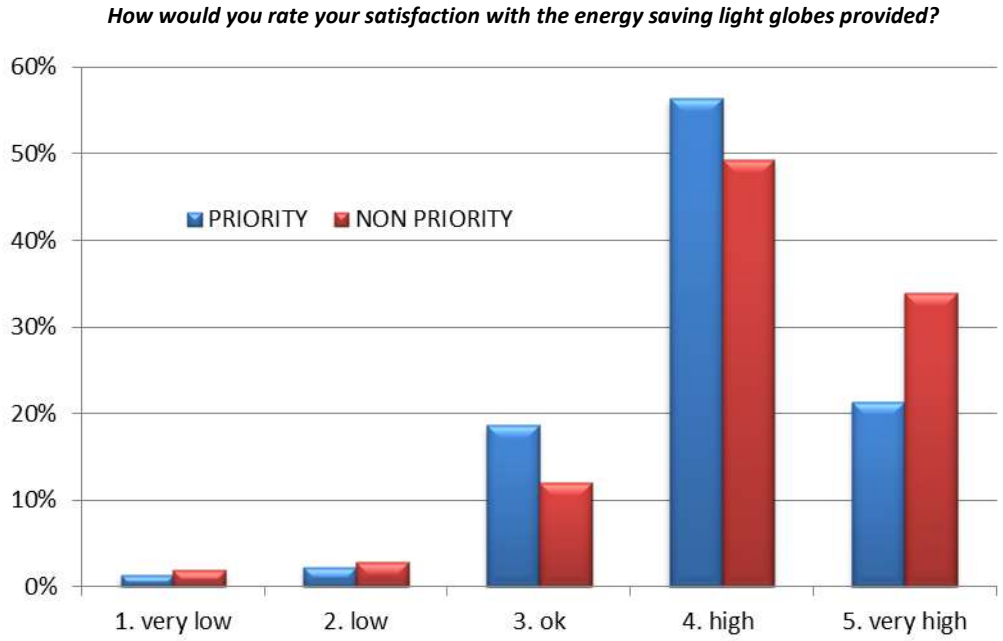


Figure 5.4

REES survey result: Satisfaction with energy saving light globes

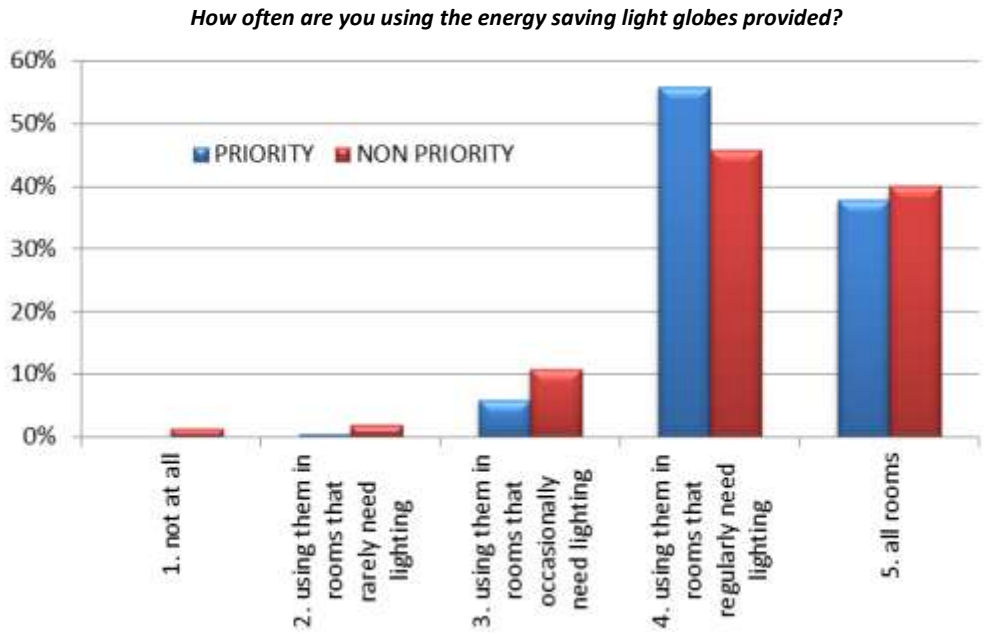


Figure 5.5

REES survey result: Frequency of use of energy saving light globes

Low-flow showerheads

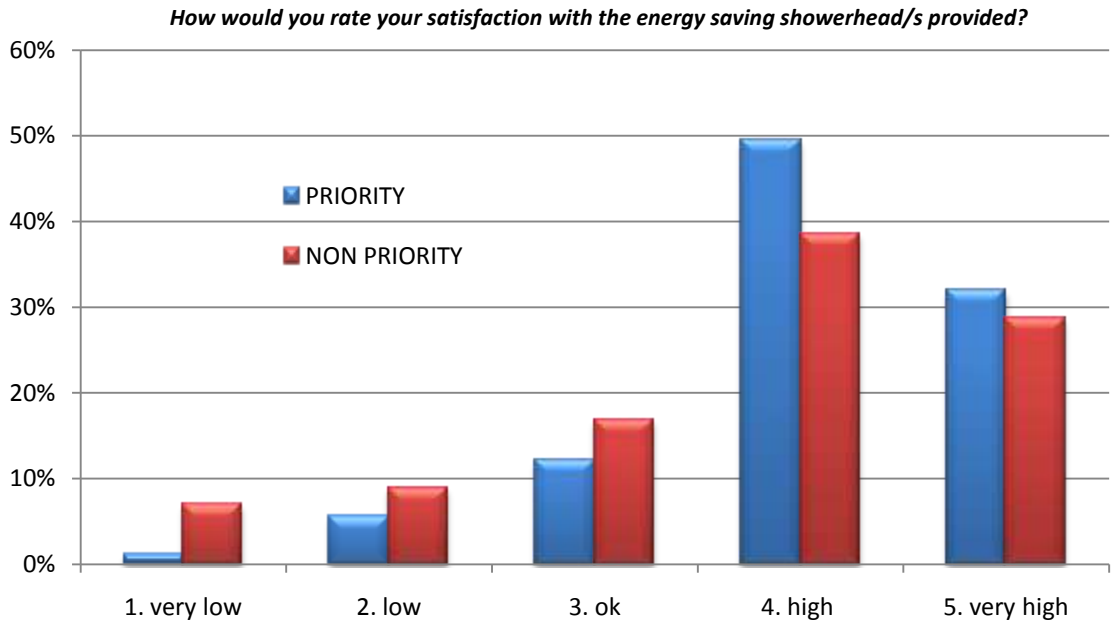


Figure 5.6

REES survey result: Satisfaction with the energy saving showerheads

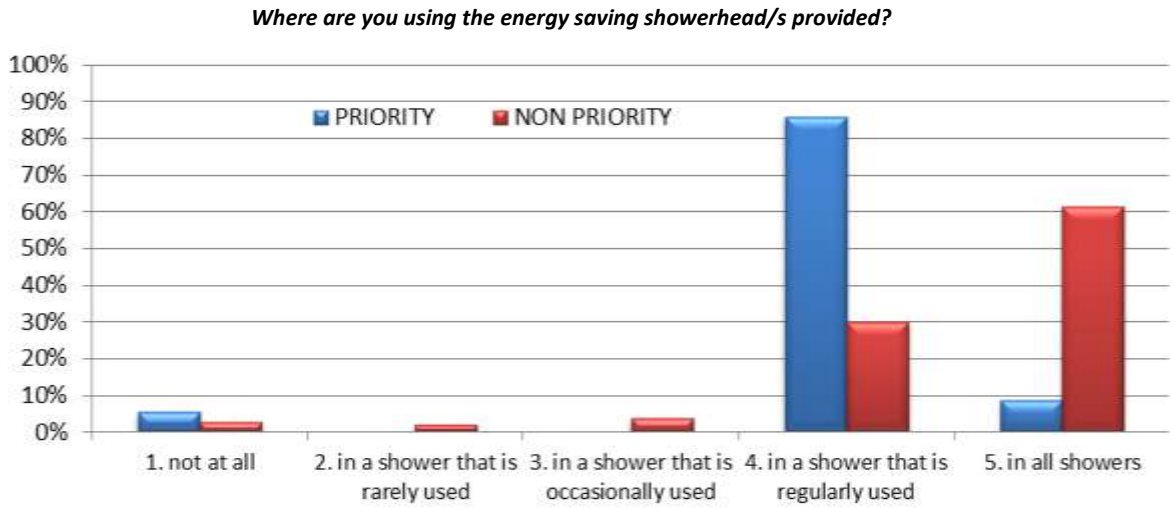


Figure 5.7

REES survey result: Where the energy saving showerheads are being used

Standby power controllers

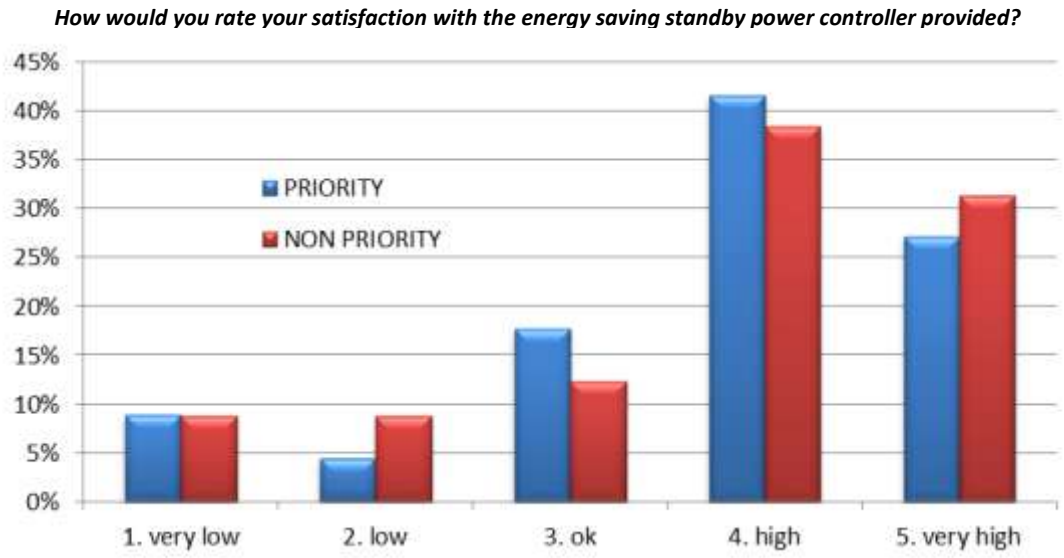


Figure 5.8

REES survey result: Satisfaction with energy saving standby power controller

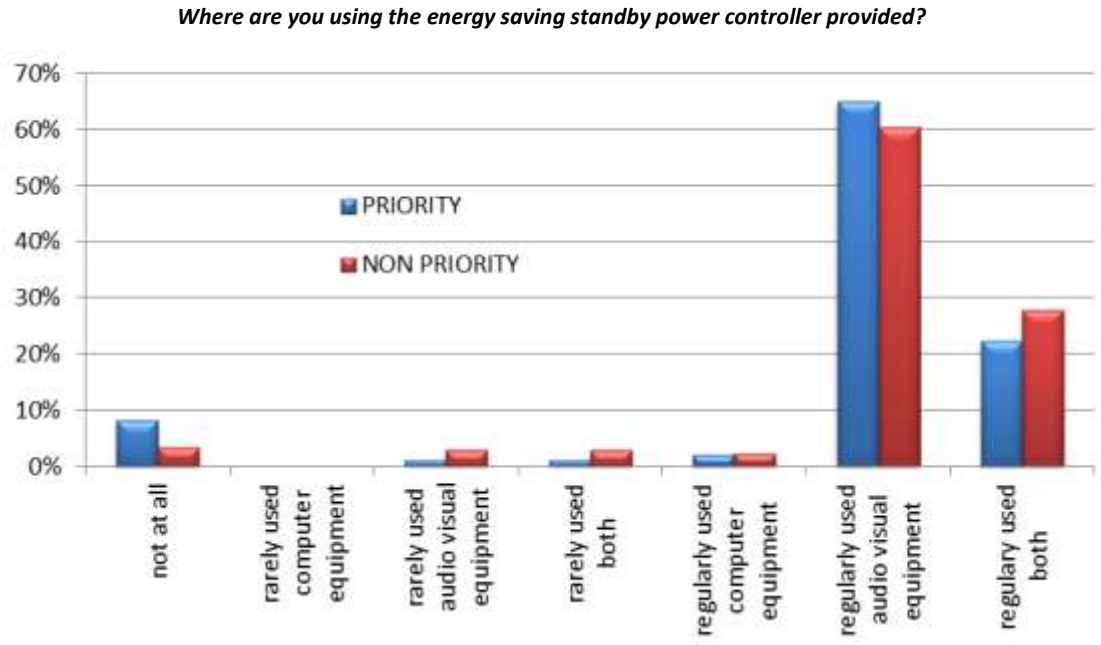


Figure 5.9

REES survey result: Where the energy saving standby power controller is being used

Nevertheless for many the impact on overall energy use was unclear. While most discerned a small to moderate impact, many were not sure what impact the devices were having. Around six times as many households from the non–priority group considered that the devices were having a big impact as households from the non-priority group. 7% of priority group households and 5% of non-priority group households considered that their energy use had gone up as a result of the devices installed.

How much impact have these energy saving products had on reducing your household energy use?

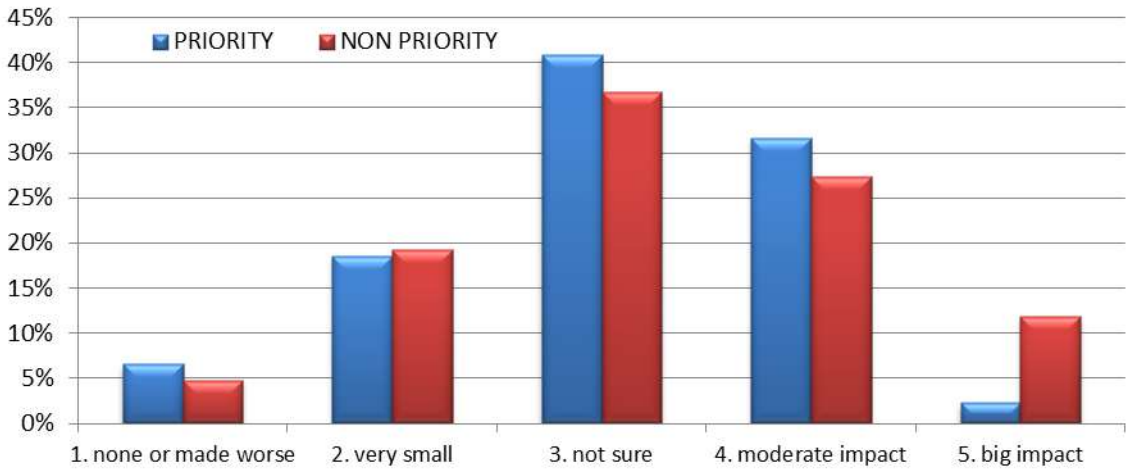


Figure 5.10

REES survey result: Impact of energy saving products on household energy use

5.3.2 Energy audits

Energy audits were provided to around 9250 homes in the 18 months prior to February 2013. Responses from 269 households underpin the following results. Their recollections and perceptions suggest thoroughness on the part of auditors and strong levels of satisfaction with the quality of service and follow up.

- Nearly half the auditors spent between 30 minutes and an hour reviewing the household's configuration and energy use, and 12% spent more than an hour.
- Only 9% of audits took 15 minutes or less.

Further, the survey evidence suggests that auditors took care to explain their recommendations with over 60% taking 10 minutes or more. Only 12% spent less than 5 minutes.

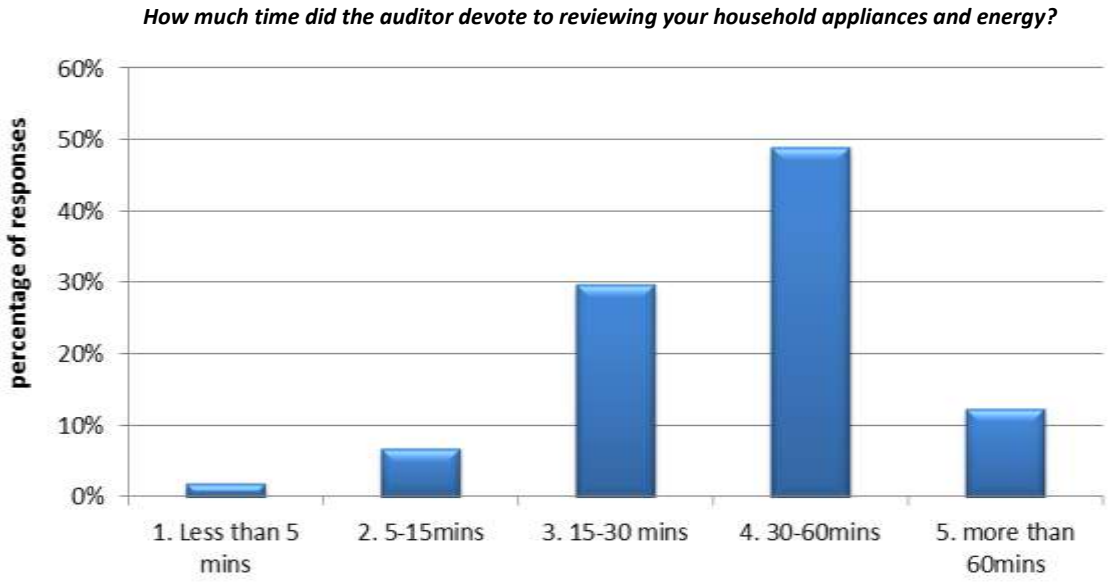


Figure 5.11

REES survey result: Time devoted to household energy efficiency audits

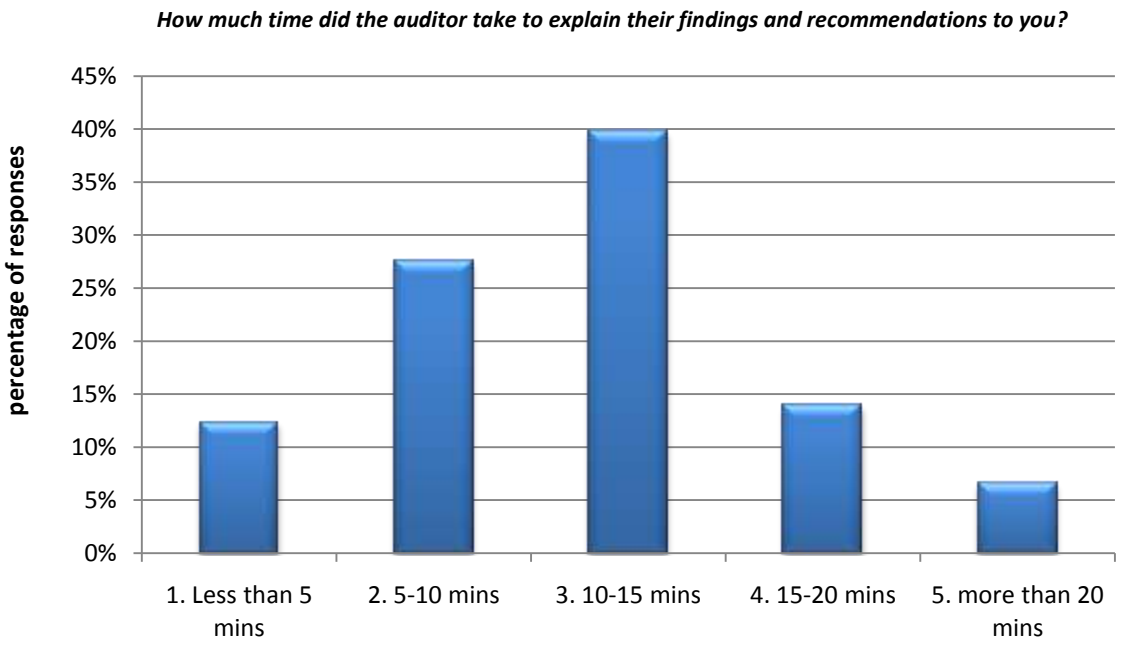


Figure 5.12

REES survey result: Time devoted to explaining findings and recommendations

Fifty-four per cent of respondents also reported that they received a follow up call or visit. However 23% stated that they did not receive any follow up (a further 23% were unsure). Of those that received follow up 58% found the follow up calls either helpful or very helpful, while only 3% had a negative view of the value of the follow up.

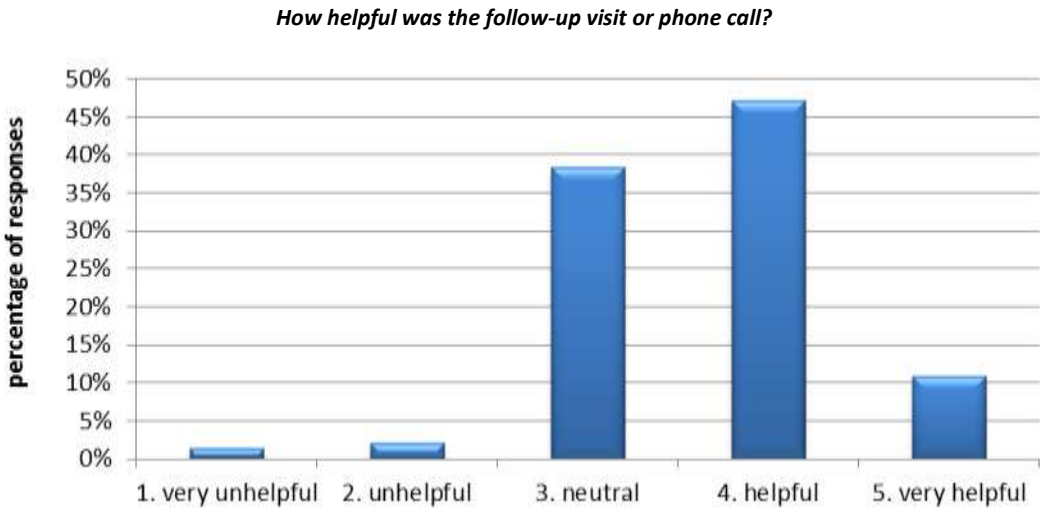


Figure 5.13

REES survey result: Helpfulness of the follow-up visit or phone call

For most audit recipients, a small list of suggested actions was developed. The survey indicates that one or two suggested actions were most common, while only 2% of respondents reported six or more. However, 30% of respondents recalled that no actions were proposed.

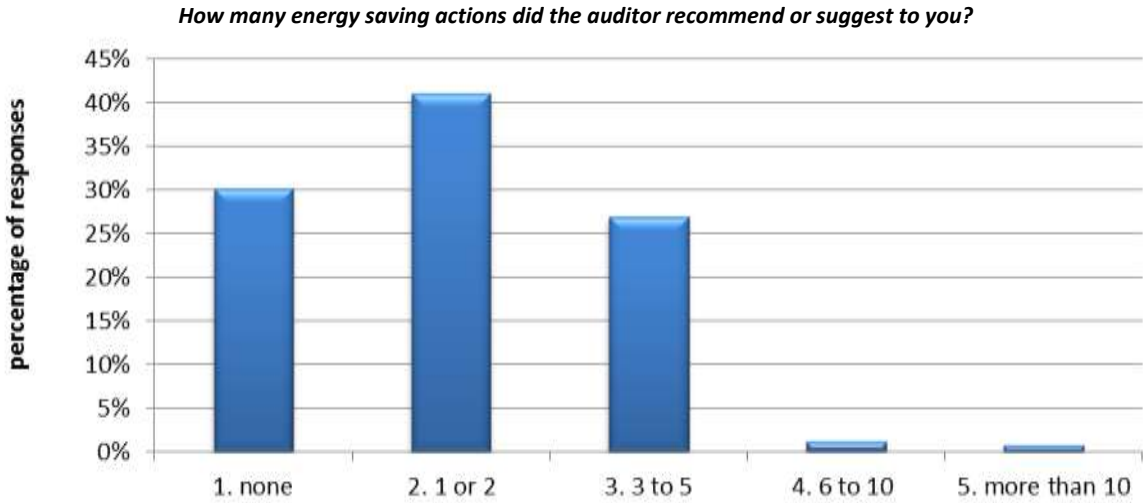


Figure 5.14

REES survey result: Number of energy saving actions recommended

However, most recommendations were well received, and acted on. Of those with audit recommendations:

- 49% of respondents embraced all the actions put forward;
- 11% took up most of the actions;
- 17% adopted at least a few;
- 23% adopted none of the actions recommended.

Reasons for failing to adopt the audit recommendations varied. The key single reason given was 'too expensive to implement' (28%), followed by 'I couldn't see a benefit' (18%) and 'I've been too busy' (14%). 37% of 'non-adoption' was for other reasons. Common responses in this category included 'the change wasn't practical for me to do' or 'my situation has changed'.

Nevertheless, the overwhelming majority of audited households were satisfied with the quality of the service provided, with 46% of respondents saying that they were happy with the quality and reliability of the residential audit they received, and 45% saying they were very happy. Only 8% expressed mixed or negative feelings about the quality of the service.

Against this, and reflecting the number and uptake of audit recommendations, there was a fairly wide distribution of expectations around what the audit (and adoption of recommendations) would deliver:

- 37% observed that the audit process had made a minimal difference to their household energy consumption;
- 28% thought it had led to a moderate improvement;
- 30% were unsure of any material difference.

Interestingly, 3% thought the audit had led to a big improvement in their household energy consumption, while 2% reported that it had gotten worse.

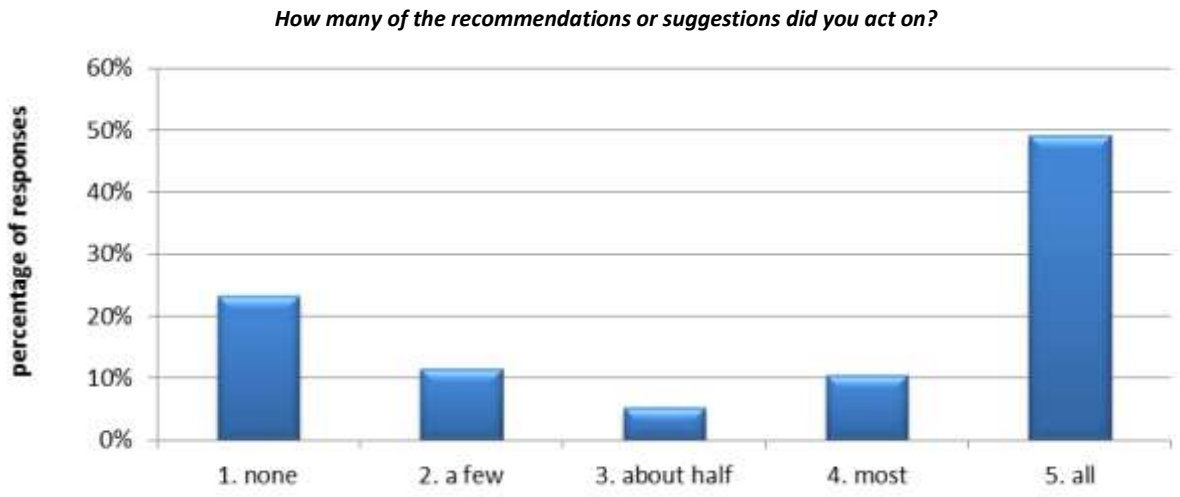


Figure 5.15

REES survey result: Number of recommendations acted on

5.3.3 Overall impressions of REES

Consistent with the results above, most households strongly endorsed REES, and felt there was likely to be at least a moderate benefit to them from the scheme. Generally priority group members were most enthusiastic about REES.

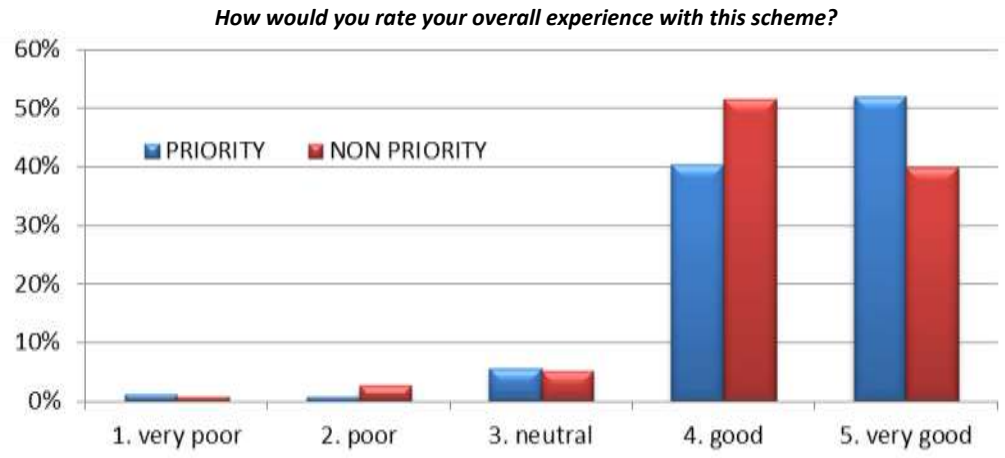


Figure 5.16

REES survey result: Overall satisfaction with REES activities

There is some evidence to suggest that this is a receptive group for assistance in this area. When asked if REES has caused them to take further energy saving measures, 45% of priority group respondents said that they already were pursuing these opportunities, while 27% in the non–priority group (versus 15% in the priority group) affirmed that REES had encouraged them to pursue energy efficiency improvements more vigorously. Over 77% of non-priority group respondents and 49% of priority group respondents expected to achieve at least a moderate amount of energy savings from these extra REES-induced activities.

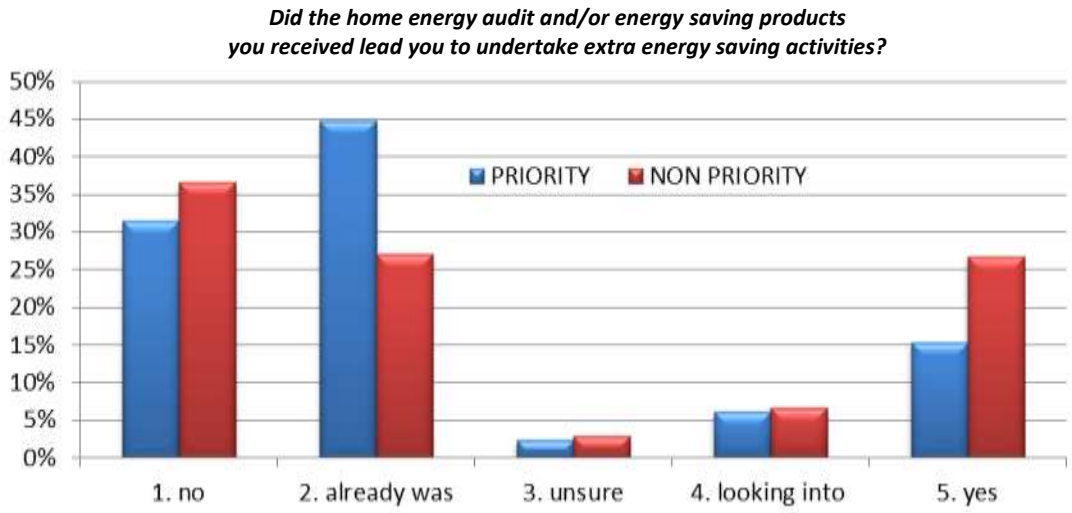


Figure 5.17

REES survey result: Awareness raising and multiplier impact of REES exposure

5.4 Further insights from the REES database extract

The REES data provided as the basis for the survey provides some additional insights to the availability and spread of energy efficiency opportunities across South Australian households.

Confidentialised unit records for more than 5600 activities occurring in over 2100 households were provided in the REES data extract, comprising samples of the priority and non–priority group participants. Postcode information was matched with 2009–2010 data from the Australian Tax Office to indicate the average taxable income levels for individuals for each of these areas. The distribution of deemed emission savings per household versus average income levels for the postcode area are shown in Figure 5.18 (observations with less than ten households in the postcode area were deleted to avoid distortion by anomalous results).

The figure indicates the strong contribution that low-income households make to the flow of energy efficiency improvement and GHG abatement stimulated by REES. It is reasonable – given efforts to discard small area samples – to interpret this as an indication of the opportunity for low-cost efficiency improvement across households of differing income levels.

The distribution shows a distinct bunching for households in areas where average taxable income is less than around $55,000 per year, and some tendency for the average savings to grow in areas where income is below $45,000 per year. Importantly, it appears that at virtually any income level there are (on average) prospects for energy efficiency improvement. REES experience to date suggests (based on the key devices issued under the program) that an average of 4 t CO_2-e savings is readily achievable from individual households across the community.

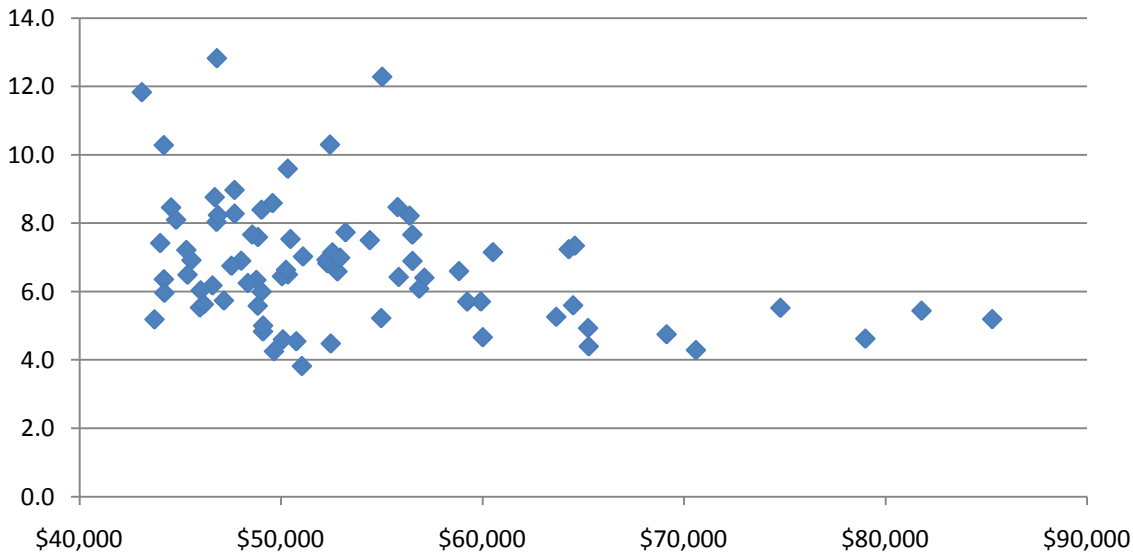


Figure 5.18

Average deemed GHG savings per household (t CO_2-e) versus average income levels (by area)

The data also reveals an interesting pattern of savings being achieved by members of the priority and non–priority groups. As Figure 5.19 reveals, REES activity represented in the data extract has produced an average (deemed) GHG saving of about 6.8 t CO_2-e per household, but possession of a concession card does not necessarily imply a household presenting a large opportunity for savings. Based on the sample, the (deemed) GHG saving per household achieved under REES averaged around 7.3 t CO_2-e for non–priority group members, but only 6.4 t CO_2-e for concession card holders (who comprise the priority group).

Further, this result unpacks to suggest that, based on a sample of around 2100 REES recipient households and 48 Commonwealth health card holders captured within that group, holders of these cards offer a key source of straightforward energy savings (consistent with the current REES roll out) – with an average CO_2-e saving equal to around 8.8 tonnes, while other concession card holders offer only around 6.2 tonnes per household.

There results deserve further investigation – ideally in the context of the extended REES dataset. Smaller household size and occupancy levels, in combination with potentially lower penetration of computer and audio visual equipment, can help explain the lower average savings achieved for priority households on average, but the high value for health card holders is less clear. The contrast with the key result of the previous figure – that savings potential tends to be inversely related to area income – is also noteworthy. These results might be interpreted as contributing some empirical evidence to the claims made by welfare groups that by focusing priority on concession card holders REES is missing many other disadvantaged households with equal or greater potential to benefit from the scheme.

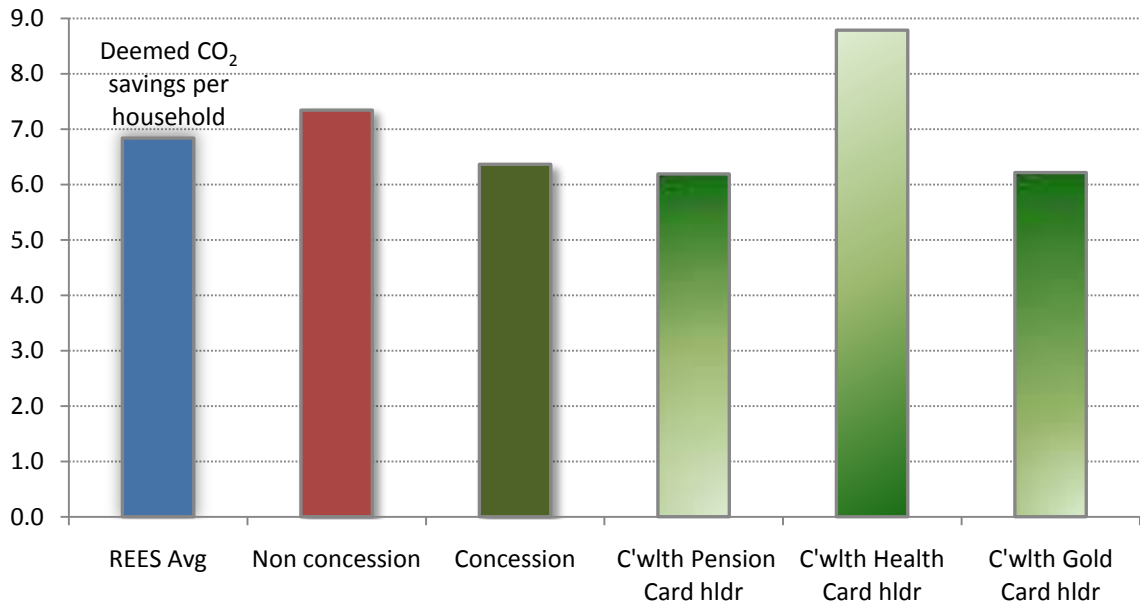


Figure 5.19

Average REES GHG savings per household, by welfare entitlement

6 Potential design enhancements

The Terms of Reference for this study required an assessment of how the cost effectiveness and efficiency of REES in meeting its objectives might vary with a wide range of alternative scheme design options. Further, and as noted earlier, additional options were identified by a range of stakeholders during the review process. This section reviews and assesses these options.

6.1 Significant future design and target choices

6.1.1 Fuel coverage

Fuel coverage refers to the number of fuels for which eligible activities are able to be identified under the Scheme. At the moment these are limited to electricity and natural gas. Other fuels used in the residential stationary energy sector include LPG and firewood. In South Australia, these fuels account for some 15% of residential fuel consumption, with the vast majority of this being firewood. While there are differences in the efficiency of wood fires, these are highly contingent on factors such as wood quality, type, moisture content, etc. Practically, it may not be feasible to establish reliable deeming methodologies for wood heaters.

The other fuels used by the residential sector are transport fuels such as petrol, diesel and minor fuels such as LPG, LNG and biofuels. Coverage of these fuels would be possible in theory, but very difficult in practice. Liquid fuel consumption (and gaseous fuel consumption specifically for vehicles) is not metered or monitored at the household level. Sales at petrol stations, etc. would include sales to all end-use sectors and to interstate drivers. To a greater extent than for stationary energy end-uses, differences in the specific energy consumption of vehicles is much more affected by behavioural factors like driving styles, while total energy consumption is greatly affected by kilometres travelled. 'Nameplate' (or ADR) energy efficiency would provide a reasonably poor indicator of differences in actual energy consumption from one vehicle model to the next. In short, it would be difficult, and doubtless controversial, to strike a representative set of deeming methodologies for transport fuels, and even more difficult to verify actual energy savings.

Further, it is noteworthy that no stakeholder raised any issue or question with respect to fuel coverage, despite our questionnaires prompting them to offer such views. We conclude that while it would be possible to widen the fuel coverage, this would not appear to be a high priority and may, in any case, contribute little to the Scheme's objectives.

6.1.2 Sector, facility and party coverage

REES is one of a family of policy measures known as 'economic' or 'market based' measures. One of the inherent advantages of these measures is that they are flexible and scalable in terms of their sectoral and facility coverage. In principle, any type of facility or end-use sector can be named as either a liable sector (required to meet an energy savings target) or as a beneficiary (able to generate eligible savings). Further, there is no reason in principle why the liable parties and the beneficiaries need to be in the same sectors (although see a qualification below). The schemes, like REES, impose an obligation on certain parties, and create avenues for that obligation to be acquitted. Each of these elements can be varied independently.

The coverage of similar schemes varies throughout the world, with a range of sectors and facilities targeted for each scheme. With regard to the energy use sector, it is recognised that energy supplier obligations work particularly well with residential and small business sectors. This is in part due to these sectors being harder to reach by market driven factors, and the ability of energy suppliers to establish a relationship with these customers. Other sectors are included in certain international schemes, with varying success, and the choice of sector will depend on the local situation. In Europe, larger industrial and commercial users already participate in the EU Emissions Trading Scheme and other national agreements, and therefore additional obligations would duplicate certain targets.

The effect of including additional sectors or facilities as liable parties under REES would be:

- to spread the 'burden' of the scheme across a wider group of parties, and a wider section of the economy, meaning a lower burden per party for any given target;
- to increase the number of parties facing compliance costs and, most likely therefore, the total compliance cost for the scheme, again for any given target size (as there are fixed costs, such as reporting, for all liable parties).

These two effects are opposite in sign; however, there is a risk that the total cost of compliance would be higher, for any given target size, the greater the number of liable parties. In principle, therefore, such an outcome would not be desirable unless there were offsetting benefits or other equity or efficiency gains. These possibilities are considered further below.

A second variable is the sectors in which eligible activities or savings can be generated. Again, there is no a priori reason why these sectors need to be the same as the sectors in which the liable parties are. Even in the current REES, the liable parties (certain electricity and gas retailers) may not operate exclusively in the residential stationary energy sector, which is where the beneficiaries are to be found. In Section 6.1.2, for example, we demonstrate that it would be cost effective to widen the sectoral coverage for activities to include the commercial sector. This could be limited to commercial buildings, as an energy end-use, or alternatively could include energy use by all small and medium sized enterprises. However, we also note that a decision to widen the sectoral coverage in this manner may well have implications for the objectives of the scheme (e.g. social policy objectives). If energy savings can be generated more cost effectively in the commercial sector, for example, then – without additional constraints being imposed – it is possible that few energy savings would be generated in the residential sector, to the detriment of the Government's objective of reducing energy cost burdens on low-income households.

Large industrial/mining enterprises or facilities would likely be excluded from coverage on the grounds that (a) they are large enough to bring sophisticated management strategies to their energy and/or carbon price risks without support from REES, and (b) they are already covered by major schemes such the Energy Efficiency Opportunities program and NGERS reporting obligations, so there may be little additionality in their inclusion.

As discussed in Section 4 above, France has recently introduced the transport sector into the targets. The results from this are yet to be published, but it will be interesting to see whether the EEO scheme can generate cost effective emission reductions within this sector. It is worth noting that transport was previously included as an option within the obligation, but there was no specific transport related target, and only 0.3% of savings were generated from this sector (IEA 2012). The case for including

transport within REES has been largely covered in the section on fuel coverage above. Apart from the general benefit of spreading any given target across a wider number of liable parties, there would appear to be very significant practical difficulties in bringing transport energy use within the scope of REES. Also, we note that no stakeholder is calling for such an outcome.

The 2012 IEA/OECD workshop highlighted some areas of general agreement with regard to sector coverage:

- energy supplier targets for residential and small industrial/tertiary sectors have proven successful in many countries;
- for larger industrial and commercial users, other methods for reducing energy use may be more effective, and in many countries, including Australia, other mechanisms are already in place to target these sectors, making additional targets more problematic;
- targeting transport is still unproven, and therefore the French scheme will provide a useful case study for whether this can be effective;
- the agriculture sector requires more work to develop measurement and verification, and methods for calculating deemed savings for chosen measures.

In considering the case for changing the sectoral coverage of REES in particular, we would offer the view that where the liable parties and the beneficiaries have no direct interface (for example, if petroleum refineries became liable parties and yet eligible activities remained restricted to residential electricity and gas consumption), then it is unlikely that those liable parties would be able to exercise much innovation in delivering on their obligations. It is likely that outcomes in this case would be 'more of the same', rather than delivering qualitative differences. To extend the above hypothetical example, refineries might acquit their liability by commissioning the same service providers as today to deliver more of the same activities. Practically the outcome might be the same as leaving the sectoral coverage unchanged but instead lifting the target – except that administration and compliance costs would be higher, as noted above.

From a longer term perspective, if it is seen as desirable for an efficient private market in energy savings to evolve, including as stimulated by policy measures such as REES, then it would indeed be desirable for each scheme to engage natural synergies and to deliver innovative solutions. This is more likely when there is a direct and ongoing commercial connection between the parties.

A special case might exist if targets were lifted substantially – sufficient to impose a large burden on the South Australian economy. In this case, the need to spread the burden equitably may become the dominant policy design criterion, and this would argue for increasing the sectoral coverage of liable parties, notwithstanding the risk of higher compliance costs overall. However, even in such a case, there would an argument in economic efficiency to also widen the coverage of eligible activities at the same time, in order to bring as many low cost abatement opportunities as possible into the scheme, thus lowering the total cost of compliance for any given target level.

6.1.3 Obligated party thresholds

As a result, there does not appear to be a strong case for expanding the scope of obligated or liable parties. A particular concern raised by some retailers addressed the 5000 customer threshold for liability under REES. It was noted that there is the potential for this threshold to place some retailers at a competitive disadvantage relative to others. In our view, this risk is enhanced in South Australia following the deregulation of retail prices, as the avenue of guaranteed cost recovery for liable parties via a regulated tariff has been removed. Further, since there is a tendency for some retailers to focus on a smaller number of larger companies – generally in the commercial or manufacturing sectors, including minerals processing – then the case for altering, lowering, or even removing the threshold is strengthened should commercial energy use be brought within the scope of future REES targets. Indeed, we recommend that the retailer liability threshold be reduced to ensure competitive neutrality between retailers in the event that commercial energy savings are brought within the scope of REES targets. We note that changing the threshold to a metric of annual energy sales in MWh or GJ, rather than customer numbers, could facilitate such an outcome.

In summary, widening the sectoral coverage of REES to include commercial or small and medium sized enterprises within the scope of eligible sectors, could improve the cost effectiveness of the scheme, particularly with respect to its objective of reducing GHG emissions (implicitly at least cost). However, there does not appear to be a strong case for widening the scope of liable or obligated parties. In the event that commercial energy use is brought within the scope of REES, we recommend that the retailer liability threshold be amended to ensure competitive neutrality between retailers, for example by altering the threshold metric to annual energy sales rather than customer numbers.

6.1.4 Performance indicators

Performance indicators, in this context, refer to the 'metrics' used to set (and acquit) the REES targets. At the moment, the targets are expressed in terms of GHG emissions and quantitative targets for audits linked to priority groups. Numerous issues have either been raised by stakeholders in this area or arisen in our analysis. These are discussed in turn below, from the perspective of whether changes from the current REES design would be likely to enhance the efficiency or effectiveness of REES in meeting its objectives.

6.1.5 Energy or greenhouse targets

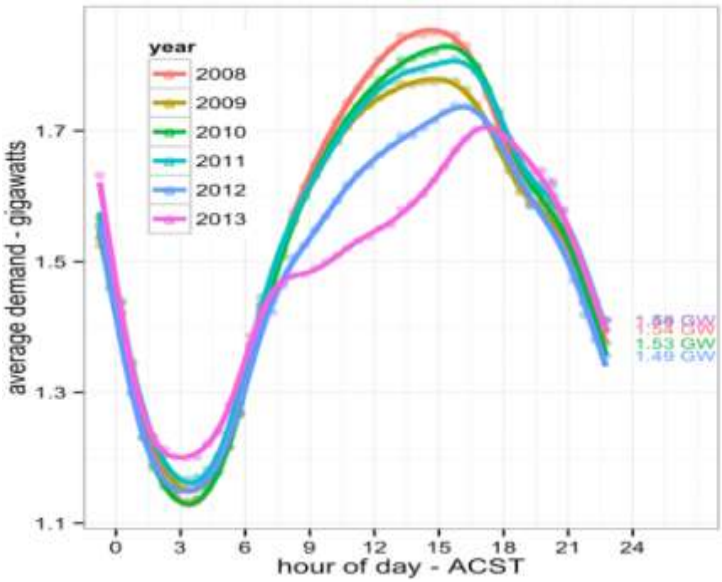
While a key objective of REES is to reduce GHG emissions in South Australia (totalling around 1.65 Mt CO_2-e over the longer term from the 2009–2014 operation of the scheme), the choice of GHG emissions as a target metric could be questioned. The only eligible pathway for meeting this target, under the scheme, is to reduce energy consumption, principally electricity and gas. While the GHG intensity of gas is essentially constant (or at least is assumed to be), the greenhouse intensity varies annually as a function of the changing fuel mix used for power generation, and also – from the perspective of individual states – due to interstate trade patterns. Indeed, South Australia's greenhouse intensity of electricity supply has fallen by 20% since 1990, due primarily to the growing share of wind and other renewables in the supply mix. With the coal-fired power station Playford mothballed, and a growing national renewable energy target, this figure is likely to fall further over time. This means that under REES, more energy savings will be required, at greater cost, for any given level of GHG savings targeted.

A second reason for considering a change to energy savings as a target metric is that it is the value of energy savings that creates the primary economic benefit under REES. Further, with a carbon pricing scheme currently in place, market energy prices (for electricity and gas, in any case) carry an additional price assumed to represent the incremental value of the carbon savings implicit in Australia's national GHG abatement target (–5% over 2000 by 2020).

6.1.6 Targeting peak energy savings

Peak energy demand refers to the relatively short-lived demand for electricity in particular (although peak demand for any fuel can be important when the capacity of supply infrastructure is constrained), which in South Australia typically occurs in the late afternoon during summer heatwaves – and particularly during a longer heatwave. Very considerable expenditure is required to install the infrastructure necessary to cover peak electricity demand, and yet this infrastructure may only be used for a few tens of hours per year. This means that the productivity of this investment is very low. Nevertheless, electricity network businesses are able to recover this investment for electricity users via higher 'network use of service' charges, imposing a significant cost on them in return for a modest benefit. Indeed, this effect has been the primary cause of rapidly rising electricity prices in Australia in recent years.

While the current weakness in the Australian economy has seen peak electricity demand fall in Australia and South Australia in recent years (Figure 6.1), in principle, and over the longer term, there is a sound economic case for investment in activities that lead to cost-effective reduction in peak demand. This has led some stakeholders, and retailers in particular (who are exposed to high pool prices during peak demand events, and who therefore incur costs to hedge the price risks involved) to call for such peak-reducing activities to be included within the scope of eligible activities under REES.



Source: http://reneweconomy.com.au/2013/how-rooftop-solar-is-reshaping-energy-market-in-s-australia-18272/sa_2008_td_time_of_day_average (accessed 4 March 2013)

Figure 6.1

South Australian average summer demand for electricity, 2008–2013

As an illustrative example, REES could support the replacement of old residential air-conditioners with new high performance appliances (with optimal impact on the overall energy performance improvement of the household when these actions take place in dwellings that are also well insulated and draught proofed). Such an approach would need to be carefully managed, with replacement of appliances with COP <2.5 (say), which could be linked to a particular year. The initial focus could be on replacing old window units. Current split air-conditioners have COP >4. This means and old 2 kW (electrical) air-conditioner, delivering 5 kW (cooling) could be replaced with a 1.25 kW (electrical) air-conditioner, delivering 5 kW (cooling). The overall saving for 400 hours per year of use would be 500 kWh of electricity and the corresponding emissions, plus a decline in peak load of 1.25 kW, currently valued at ~$500. (EES 2011). Such a program would be more expensive per activity than the REES current approach.

As noted in Section 1, the objectives of REES focus primarily on reducing GHG emissions and associated carbon costs; however, the third objective is 'to reduce total energy costs for households, particularly low-income households'. Reducing peak demand may lead to lower energy costs for households in South Australia, although this is uncertain and contingent. During times of falling peak demand and low expenditure on associated network assets, such as exist at present, there will be no direct cost savings attributable to further reductions in peak demand – the investment is sunk. Even in times of peak demand growth, the extent to which cost savings associated with peak demand reductions by households are passed back to them in the form of lower energy prices is at best uncertain. First, the extent of savings realised by retailers will depend on their hedging decisions, and second, the extent to which any savings to retailers are passed on to householders – particularly following retail price deregulation in South Australia – will depend upon competitive pricing decisions. Any such benefits for householders are likely to be delayed and difficult to attribute to specific peak-reducing actions or investments. Further, there is neither mechanism in place nor reason to assume that the majority of any such benefits would fall on low-income households.

Overall, therefore, we believe the case for including peak demand reducing actions within REES is weak. If this class of activities were to be included, they would risk displacing energy saving activities that would unequivocally reduce energy costs for householders, including low income households. This would detract from the objectives of REES. If there were a sentiment to include peak demand abating activities, this should be done in the context of lifting the overall energy/greenhouse targets, to ensure that this displacement effect does not reduce the overall benefits of the scheme to householders.

6.1.7 Audits

The target metrics for REES include numerical targets for annual audits, rising to 5667 audits in calendar 2014. Audits must be delivered to priority groups, including concession card holders and those experiencing energy hardship (difficulty in paying energy bills). Stakeholder views on the value of these audits, and also how they should be targeted, varied considerably (as detailed in Section 5). While the results were mixed, the beneficiaries of the audits generally valued them (over 90% reporting that they were 'happy' or 'very happy' with the quality of the service provided; over 60% reporting that they had implemented most or all of audit recommendations; but only 31% reporting a moderate or substantial improvement in energy consumption). The modest reported savings outcomes would generally be consistent with the modest nature of the recommendations made, together with the possibility of some over-reporting of implementation rates (optimism bias), and difficulties in linking changes in appliance energy use to changes in the household energy bill.

We note that, apart from the one-off survey undertaken as part of this review, there is no ongoing mechanism for evaluating the effectiveness of audits under REES. Some survey respondents also report a 'cursory' approach to audit delivery by service providers, and no effective outcome, although this would appear to be in a minority of cases. We recommend that retailers be required to retain the written reports of the audits conducted on their behalf by service providers, and that ESCOSA audit a random sample of these reports on an annual basis. Further we recommend that a further survey of audit recipients be conducted prior to the completion of REES Phase 2, to inform decision-making with respect to the inclusion of audits in any extension of REES post-2014.

Some retailers and some service providers called for audits to be recognised as an 'activity' under REES, and therefore eligible for deeming credits. However, the results of our survey would suggest that it would be difficult to establish a credible deeming rate, in particular given the low reported incidence of energy savings attributable to the audit alone. Inclusion of audits as an activity would risk to displace more certain energy savings measures, thereby detracting from the objectives of the scheme. Were the South Australian Government disposed to include audits as an activity, we would recommend that this be:

- undertaken in the context of an increase in the REES energy or GHG abatement target;
- subject to establishment of a credible deeming methodology and rate by ESCOSA; and
- subject to after-the-fact validation of expected energy savings using primary research techniques (survey, monitoring, attribution).

Finally we note that the spectrum of stakeholder views with respect to audits included the view that the target be removed; that it be lifted (for example, to 10,000 annually); that the nature of the audit process be changed (in particular, to facilitate education and behavioural change outcomes); and that an incentive be provided for the delivery of audits (inter alia) in regional/remote areas. The latter point is discussed in Section 6.1.9. With respect to the others, the 'mixed' nature of our survey findings with respect to the effectiveness of the current audits do not appear to support either abandonment or a major expansion of the current audit program and targets. Similarly, while there is intuitive appeal in the view that longer audits, with an explicit objective of achieving educational and behaviour change outcomes, may deliver greater energy savings, including for priority groups, it is also unequivocal that this would increase audit costs. It may also require retraining of audit service providers. Therefore it is essentially a policy research task, and beyond the scope of this review, to compile a quantitative evidence base to examine whether expected incremental benefits (energy savings) would be likely to exceed the expected incremental costs. Such research could be conducted prior to the end of 2014, informing decisions with regard to the nature of audits under REES in any post-2014 period.

6.1.8 Priority group targets and incentives

A number of research papers have discussed the issues of targeting low-income households and those that are at risk of fuel poverty. There is a general consensus that targeting these groups is important, but also a concern that a focus on low-income groups may shift emphasis away from reducing GHG emissions and towards social welfare. Some of the reasons for supporting these groups are as follows.

- Low income households spend a greater proportion of their disposable income on fuel in general, therefore finding it harder to absorb energy price rises.
- Houses tend to be less efficient to begin with, with older, less efficient appliances, such as hot water systems, refrigerators and insulation.
- Lack of access to financing, reducing their ability to implement longer term measures that require up front capital expenditure.
- Lack of information regarding possible energy efficiency measures that could be applied.

One paper by The Brotherhood of St Laurence (BSL 2012) highlights the importance of establishing specific targets for low-income households, to ensure that they receive a proportion of the higher value efficiency measures. It has been shown in the VEET scheme that although low-income households received an equitable share of VEECs, the distribution of higher value measures was far lower for this group. This view point was also backed up by Wilkins (Wilkins 2008), who argues that low income households represent an example of market failure, and therefore require specific action to address their needs.

This subject was also discussed as part of an IEA workshop on EEO schemes, with representatives from various stakeholders, including energy providers, regulators, government, consumers, energy efficiency industry and others. There was general agreement that there is a valid underlying issue regarding the lack of poverty alleviation measures, and specific targets within EEOs can help address this from an energy perspective. Recommendations by the IEA included investment into the creation of a database of building stock according to tenure, helping to quantify and measure both the energy saving benefits and additional benefits (such as health) arising for low-income households. This could then help distribute additional funding from government areas that are focused on social issues (Heffner and Lees 2012). Suggestions also included greater transparency for the actual cost to energy providers to meet their energy savings targets, and an understanding from governments that intervention may still be necessary for low-income households that fail to benefit from the scheme.

The BSL also notes that multipliers should not be used as a mechanism to promote a higher proportion of measures applied to low-income households. Their reasons include that multipliers unnecessarily increase the entire cost of the program, even when there is no additional cost in delivering improvements to such households.

While some stakeholders called for incentives – for example in the form of multipliers on deeming rates – to assist in delivering services to priority groups, no strong case has been made to support such a call. REES appears to be delivering on its priority group targets (which is a distinct issue from that of the precise nature of the priority groups targeted, as discussed below), and the process used by retailers to acquit their liabilities under the scheme provides for efficient price discovery, including with respect to the services that must be provided to priority groups. Therefore we make no recommendation regarding such incentives.

A number of stakeholders called for the definition of priority groups under REES to be altered. Most retailers called for the priority group to be expanded to include those on retailer hardship programs, apparently unaware that this is already a priority group under REES. A simple communication by the Department or ESCOSA to retailers should suffice to correct this misunderstanding.

Separately, however, welfare groups and service providers tended to agree that targeting concession card holders represented an inadequate means of identifying households most at risk of energy poverty or social stress. They noted that some concession card holders – for example, retirees with modest energy consumption habits – may not experience particularly energy cost hardship, despite rising energy prices. At the same time, they considered that the 'working poor' – often larger families with one or two modest incomes – were potentially at much greater risk. Where incomes just exceed concession card thresholds, social pressures and fear of legal repercussions may lead families to forego other necessities – including food and educational expenditures – in order to pay their energy bills. Such incidences of hardship will not be targeted either by REES or retailers' hardship programs. There is nothing within the current incentive structure of REES that would be likely to lead to these issues being addressed spontaneously by retailers or their service providers, even if there is nothing in principle to prevent welfare groups or others alerting retailers or service providers to needy cases, for example via a referral process. In practice, however, it appears that the nature of contractual relationships between retailers and their service providers may act as a barrier to either of them being willing or able to act on any such referrals. Further, some welfare agencies noted that they have been unwilling to become service providers themselves due to the onerous commercial conditions and the nature of risk allocation under retailer-service provider contractual arrangements.

As a result, there would appear to be a case for altering the scheme design to better incentivise more targeted outcomes. We recommend that the Department formalise a process for referrals, in a manner that could be written into contractual relationships between retailers and their service providers. We note that while this could attract an additional cost, to the extent that the referral process alters the business model of service providers, any such cost is likely to be modest. To minimise uncertainty, and hence cost risks, the Department/ESCOSA could facilitate the referral process – for example by providing a 'one stop shop' for referrals and parcelling out referrals to retailers (and hence their service providers) on an equitable basis (e.g. in proportion to their share of the annual GHG target).

6.1.9 Regional outcomes

Some stakeholders called for incentives in order to ensure the wider provision of activities in regional towns and more remote areas of South Australia. They noted a tendency for service providers to seek 'low hanging fruit' in Adelaide and its inner suburbs in particular, and the absence of any incentive for service provision in remoter, and potentially higher cost, areas. Retailers, via their service providers, do collect postcode data in association with their service provision. Such data is presented (or commented upon) in ESCOSA's annual reports on REES. While the report for 2012 will not be published until mid-2013, there is some indication that, during 2012, service providers broadened their regional scope. This was (apparently) achieved via effective 'subcontracting' arrangements by larger service providers with smaller local service providers in regional centres such as Mt Gambier, and that this was achieved without additional costs or specific incentives. In part, such actions may be expected to occur naturally as service providers reach (or fear) saturation in more central areas. As saturation rates increase in a particular area, the percentage of successful 'door knocks' will fall, leading to increased search costs. These costs may be able to be lowered by offering services in regional centres not previously targeted by service providers. However, as new technologies are approved for use, there will always be a preference to roll these out in high density residential areas.

In short, there does not appear to be a strong case at this time for changes to the scheme design to ensure regional areas of South Australia are serviced under REES. We note that the objectives of the scheme fail to nominate regional equity as an objective – although general precepts of good public policy design would at least seek to avoid gross inequity in such outcomes. Therefore it may be sufficient for the South Australian Government to continue to monitor that regional distribution of REES outcomes and intervene if and when such action appears appropriate.

6.1.10 Estimation, verification, reporting and compliance

Generally speaking, REES stakeholders are highly complementary towards REES, noting efficient and responsive administration by ESCOSA and a general absence of onerous compliance conditions. One exception to this view was that of some retailers, who noted that penalties for non-compliance were high relative to those applying to similar schemes in New South Wales and Victoria. At the same time, other retailers noted that this provided a strong incentive for compliance and deterred gaming.

We have noted above one important issue around verification and compliance, which is the lack of monitoring and verification of audit quality and audit outcomes. We have made a recommendation above to address this gap.

A further issue that should be noted is the challenge of setting forward-looking abatement targets (based on deemed values for future energy savings) against the backdrop of significant structural change in the energy sector. We note the use of a GHG intensity of electricity supply value of 0.9 kg CO_2-e /kWh for deeming purposes, against more recent advice from the Department of Climate Change and Energy Efficiency (DCCEE) based on Scope 2 and 3 emission factors for 2009–2010 suggesting an estimate of 0.81 kg CO_2-e/KWh for South Australia. This suggests over-estimation of REES greenhouse savings of around 10%. As noted above, the value of GHG intensity of electricity supply in South Australia is falling through time, so this gap can be expected to widen unless corrective action is taken. However, accurately predicting the annual trajectory of South Australia's emission intensity is an intractable task. As noted above, we recommended that the target metric be expressed in, or converted to, an energy metric (e.g. megawatt-hours or gigajoules) to side-step the variability inherent in a greenhouse target acquitted through energy savings. However, it will be important that the greenhouse–to-electricity conversion rate used for such a calculation reflects the latest scope 2 and 3 emissions factor for South Australia from the DCEEE National Greenhouse Accounts Factors Workbook.

A further issues arises for standby power controllers, which are a source of major deemed energy and greenhouse savings under Stage 2. REES follows the approach used by VEET for 'crediting' energy and greenhouse savings from these devices (with appropriate adjustment for differences in electricity emission factor). The issue relates to the ready ability to disconnect the device – and the risk that this may occur when 'assumed' power savings are at their greatest. This relates to the fact that the highest rated power controllers interrupt active energy using devices (presumably when they have been left on accidentally or unintentionally), rather than simply cut power when these devices are in standby mode.

As a consequence, potential power savings are very much greater, but the actual savings depend critically on the 'cut out' function not interfering with the household's preferred usage patterns. If these devices are not seen as beneficial, they can be readily put to one side. In this circumstance, their actual contribution to energy savings will drop to zero. This highlights reliability issues around some energy efficiency devices and approaches, and the need to build on thorough analysis of device impacts and responses within a broad spectrum of households and applications. We understand that this analysis has been done for SPCs. Nevertheless, the risks associated with under or over-estimation point to the need for vigilance in this area.

6.1.11 Tradability of energy and emission 'credits'

Most retailers who participated in this review commented on the potential for tradability of savings under REES, although some spoke in favour and some against. Generally, however, most parties agreed that tradability could increase flexibility for liable parties, albeit at the expense of some additional cost and complexity overall (not necessarily for retailers) associated with the need to register, verify, track and potentially trade certified energy savings.

Around the world, most energy efficiency schemes that allow trading use a system of 'white certificates' which help provide a standardised commodity for trading, and also help simplify the accounting process. The majority of stakeholders favour trading. The IEA/OECD workshop in 2012 discussed the pros and cons of tradability (OECD/IEA 2012), and the advantages of allowing trading included:

- harnessing the innovation and specialization of third party market, helping to reduce costs of delivered energy savings;
- promoting new areas of innovation in energy efficiency by allowing more parties to participate;
- stimulating different energy savings activities, helping longer term reductions through multiple opportunities.

Some of the disadvantages highlighted included:

- trading between different schemes requires each scheme design to be similar;
- allowing trading will increase complexity of a scheme, creating an additional burden on administration;
- trading may increase the possibility of unethical or speculative behaviour.

In the specific context of REES, it seems clear that enabling certificate-based trading would raise the total costs of the scheme. The scheme administrator would need to replicate functions similar to those performed by the Clean Energy Regulator with respect to the national Renewable Energy Target scheme, including providing a robust mechanism for issuing legally-valid energy savings certificates, for registering them and their ownership, for tracking them through changes of ownership (trading) and ultimately for their acquittal against the targets of liable parties.

In return for these additional costs borne by the public, the compliance risk and burden for liable parties may be reduced (as some compliance risks would be shared with the generators of the white certificates, who are third parties). However, transferring costs between parties cannot be assumed to enhance economic efficiency; it merely changes the distribution of those costs. Further, since the costs to retailers of complying with REES are able to fully recovered from their customers (albeit that this may

become a less transparent process without retail price regulation in the South Australian electricity market), and secondly since the set of electricity users and the set of tax payers in the state are largely over-lapping, it is unclear that any material change in allocative efficiency would occur if costs were redistributed. However, if total costs were increased, overall economic efficiency would fall.

Under what circumstances would trading be likely to enhance economic efficiency? The primary circumstance would be where liable parties participating in the scheme have access to differing opportunity sets, with differing marginal costs of abatement and, potentially, with access to differing total volumes of abatement. Different marginal costs of abatement and differing abatement 'packages' mean that one party may be able to generate more savings than they require, and at a lower cost, than a second party. This creates the potential for a profitable trade between those parties, which also reduces the total costs of the scheme. Such an outcome could occur under REES in the future, for example were commercial energy savings brought within the scope of the scheme, along with new liable parties that focused on delivering electricity and/or gas to commercial entities. As our modelling demonstrates, the cost-effectiveness of savings in this sector may differ from the more generic profile of the current residential sectors savings being realised under REES. Also, the distribution of the savings is likely to be more uneven, and larger per customer, due to the more energy-intensive but also diversified nature of energy use by commercial, as distinct from residential, customers.

A further factor that may enhance the attractiveness, in economic terms, of tradability within REES would be if the targets were significantly larger than they are at present. Given that there would be fixed costs associated with setting up and administering a tradability regime, those cost would fall per unit energy saving as the targets were increased. Since larger targets may also bring into the scheme new sectors and new and more diverse savings opportunities, this would enhance the efficiency outcomes that could be delivered by tradability.

Overall, there would not appear to be a sound case of introducing tradability within REES in the short term, and therefore we make no recommendation in this regard. We note in passing that there would not appear to be any legislative barriers to informal and bilateral trading even under the existing REES design. At present, trading would be likely to increase the total costs of compliance and administration without generating any material offsetting savings, primarily because all parties are exposed to materially similar if not identical opportunity sets and marginal costs. As discussed further in Section 7, it is possible that tradability could contribute to an efficient scheme design post-2014.

6.1.12 Funding approach

At present, REES operates by imposing obligations on energy retailers to achieve defined energy saving outcomes across a subset of South Australian households. These obligations impose some degree of cost – but independent analysis suggests that a steady stream of private benefits is being delivered, the value of which far exceeds the cost of provision. Further, in the past the costs have been able to be fully recovered by regulatory 'pass-throughs' as determined by ESCOSA. In the more deregulated marketplace, cost passed through can be a little more challenging – though the spread of REES obligations across the dominant South Australian retailers is likely to mitigate this problem.
A set of questions then arise to the fairness and efficiency of this approach to funding the activities undertaken under REES. In principle, economics suggests that policies that target particular behavioural or resource allocation outcomes should aim to achieve these outcomes at minimal cost – including producing minimal levels of collateral distortion. This implies that taxes be applied to reduce the 'output' of socially undesirable goods and behaviours, and expanding output of socially desirable 'goods'

should be achieved through targeted subsidies. The rate of tax or subsidy should reflect (and certainly not exceed) the value of the social 'good' or 'bad' being generated. In cases where it is difficult to directly tax or subsidise a particular outcome or behaviour (e.g. law and order, national security, non-point pollution or poor household decision-making on energy use), proxies must be chosen – either as a tax base for revenue raising or as vehicle for affecting incentives and promoting targeted social outcomes. This is the world of the 'second best'. It is also the world in which much policy and regulatory design takes place.

Public finance theory suggests that, to the extent feasible, the financing of public policy outcomes should be linked to the set of beneficiaries of those outcomes. In the case of general public welfare outcomes associated with REES, the set of potential beneficiaries is very wide – at least statewide, and indeed spilling over internationally in the case of GHG abatement benefits. This suggests that, ideally, the cost of achieving REES efficiency and welfare aims should be on-budget. In this way, the cost of financing the program could be covered through general revenue (raised from tax sources that impose minimal adverse distortion on investment and consumption choices) and presented transparently for review in the annual budget accounts. Importantly, however, Constitutional limitations and tax sharing conventions can constrain the suite of revenue raising and tax base options available to Australian states. The alternative of placing the cost of REES obligations on to South Australian energy retailers can have the following implications.

- An extra impost on larger energy retailers, who have a significant capacity to shift these costs forward on to customers via higher retail energy prices (and/or regulatory pass-throughs).
- Comparatively heavier obligations on energy retailers sourcing highly emission intensive energy (e.g. coal fired electricity) versus energy with lower emission intensity (e.g. gas and wind power).
- Imposition of funding costs on a broad consumer base and a product (or set of products e.g. retail electricity and gas) which in combination are relatively price inelastic – recent work by Fan and Hyndman (2011) observed price elasticities of demand for electricity in the South Australian market of between –0.363 and –0.428[6].
- A net cross-subsidy from non-beneficiary South Australian households to beneficiary households (including a priority group of households receiving income support).
- Access to private sector governance and contract negotiation arrangements to potentially streamline delivery of the program.
- Opportunities for retailers to cost recover or derive additional benefit from the program by assimilating it into a business model that seeks to extend the offering of energy services or links REES activities more firmly to their 'triple bottom line' efforts focused on community engagement, brand recognition and reputation enhancement.

These dimensions suggest that while the REES funding model falls short of being 'ideal' from an economic perspective, it is likely to be a pragmatic response to the limited revenue sources available to the states, and encourages energy retailers to engage in more efficient use of their product.

6 See Fan S and Hyndman RJ (2011), The price elasticity of electricity demand in South Australia, Energy Policy 39(6), pp. 3709–3719 (June). The elasticities cited suggest that for a 1% increase in the electricity price, overall consumption of electricity would fall by between 0.36 and 0.43%.

In terms of gross electricity and gas expenditures in South Australia, the impost represented by REES is small under the current program of targets. However, this does not deny the need for REES designers to continue to ensure ongoing pressure is applied to ensuring objectives are achieved as cost effectively as possible, including through effective targeting of the causes of inefficient energy use, and expanded penetration of generic high efficiency devices through mandatory standards and awareness and demonstration campaigns.

6.2 Potential future design enhancements

In parallel with the longer term and structural design variations discussed above, a number of near-term changes and additions might be considered to support the efficiency aims and cost effectiveness of the scheme as it moves forward. These supplementary changes are proposed as a means of increasing cost transparency and targeting of effort under the scheme and are presented for consideration by policymakers as potential modifications to the current REES format:

i bi-annual collection and publication of average cost per tonne information on abatement generated under REES and reflected in energy retailer expenditures;

ii web-posting of a 'minimum terms' or 'standard' service agreement by ESCOSA, that could be used by newly obligated retailers as a basis for their service provider obligations;

iii expansion of the 'priority group' (in consultation with welfare groups and in the light further analysis of the REES participant dataset) to make a higher proportion of low-income and disadvantaged households eligible for assistance under REES;

iv formal development of priority group member referral services operated by charity and welfare agencies, which would provide flexibility for prioritisation of applications for assistance (with a 20% weighting applied to the appliance deeming rates for families and group homes within the 'top echelon' group);

v development of a 'real time' and web-enabled register of REES applicants and serviced homes to enable a more efficient roll-out of REES, and avoid duplication of effort and services;

vi for annual reporting purposes, REES abatement targets and compliance outcomes be calculated with reference to the current National Greenhouse Accounts factors;

vii the share of activities (and abatement) that must be focused on 'priority group' households (with the definition of this group suitably expanded to accommodate high need households identified by welfare agencies) be revised upward from 35% to 50% (this group not only presents significant opportunity for efficiency improvement, but is also likely to offer greater 'additionality' of savings induced under the program and therefore greater cost effectiveness overall) ;

viii the 50% priority group target should also be applied to the household audit requirement under the scheme (so that non-priority group households can also benefit). A 12-month follow up on a sample of these households (via phone or email) should also be implemented as a check on the value and outcomes of the advice delivered to consumers;

ix case studies of successful audit and energy efficiency improvements advanced under REES be used to expand the 'demonstration' impact of the scheme and to motivate higher levels of interest in energy saving opportunities and autonomous improvement across the community.

6.3 Overview of design options meriting further consideration

Generally, our findings are that REES is operating both efficiently and cost effectively. For the most part, this view is also shared by the majority of stakeholders. While numerous design options exist, there are few areas where a compelling case for change can be made. Key issues and recommendations are shown in Table 6.1.

Table 6.1 Key issues and recommendations

Key issue	Recommendations
The value used for the GHG intensity of electricity supply in South Australia, for the purposes of calculating REES deemed savings values, is around 10% higher than the current estimate. This may mean that actual GHG savings under the scheme may fall short of the stated targets.	▪ That the value for deeming purposes of the GHG intensity of electricity supply in South Australia be no higher than the current value for Scope 2 and 3 electricity emissions in South Australia from the latest National Greenhouse Accounts Factors Workbook. ▪ That the greenhouse/electricity conversion factor for future time periods be based on best-available estimates of the expected future value of that variable, and updated as necessary based on new information.
Since the greenhouse intensity of electricity supply in South Australia is variable (and tending to decline significantly through time), there may be a need to continually increase the energy savings (and associated cost) under REES to meet a given GHG target.	▪ That the South Australian Government consider converting (or expressing) REES targets in energy metrics (such as gigajoules), rather than greenhouse metrics (such as tonnes CO_2-e).
Inclusion of the commercial sector, or small and medium enterprises, as potential beneficiaries of the scheme, would likely reduce the costs of abatement under the scheme, as well as enable higher targets to be met cost effectively.	▪ That coverage of the commercial sector, or small and medium- enterprises, as eligible entities under REES be considered for the post-2014 period, along with approaches that target the key efficiency barriers facing these business entities.
There is currently little verification of the quality or outcomes associated with energy audits under REES, along with some evidence (from our one-off survey) that at least some households appear to derive little value from the audits even if, overall, the majority of households report satisfaction with them.	▪ That retailers be required to retain the written reports of audits conducted on their behalf by service providers, and that ESCOSA audit a random sample of these reports on an annual basis. ▪ That a further survey of audit recipients be conducted prior to the completion of REES Phase 2, to inform decision-making with respect to the inclusion of audits in any extension of REES post-2014.

Key issue	Recommendations
A number of stakeholders are concerned that REES outcomes may not be optimally targeted to those most in need of its services.	▪ That the South Australian Government formalise a process to facilitate referrals by social welfare agencies of households from a wider priority group, including 'the working poor' and those at risk of energy hardship, regardless of whether those households are concession card holders or currently participating in retailer customer hardship programs.
There are opportunities to promote greater cost effectiveness and energy efficiency gains under REES, relevant to its current configuration.	▪ That administrators consider the nine minor design changes (listed in Section 6.2) that address issues such as transparency and information exchange, priority group eligibility and the energy audit focus and skill set.

6.4 Links with a future National Energy Saving Initiative (NESI)

While an attractive concept, a national approach to energy efficiency through a National Energy Saving Initiative (NESI) seems very unlikely in the short to medium term. Different jurisdictions are at different stages of development of white certificate schemes, and there are practical obstacles to a national approach that appear to be impeding progress on this front. Given different lengths of operational experiences in different jurisdictions, it is not clear how a single set of national technical rules could evolve (e.g. different carbon intensities of electricity), and in addition how the REES target group approach could be adapted to a national program.

Another option may be to seek to integrate or coordinate future REES activity with 'top up' financing approaches being considered and developed at the Federal level. This approach is likely to have merit if REES moves into the next tier of energy efficiency where costs and energy savings are greater still and welfare aims take on a lesser role in programs designed to target efficiency improvements in the business sector.

7 The future opportunity set

REES has delivered a strong return on the resources that have been expended on it during Stage 1, and it is fully expected to do the same in Stage 2. It is demonstrably meeting its objectives of reducing GHG emissions in South Australia, preparing households for (and living with) carbon pricing and reducing total energy costs, particularly for low-income households. This section examines what outcomes could be expected were the scheme to be extended, for example to 2020. First it presents the results of economic modelling that we have undertaken, to establish whether extending REES would be likely to be cost-effective. Second, it comments on the merits of applying the design choices discussed in Section 6 in the period after 2014.

7.1 Modelling REES post-2014

The cost effectiveness of REES, were it to be extended beyond 2014, would be affected by future movements in energy prices and consumer responses to them, the availability of additional energy saving opportunities offering a high pay-off, and any decisions to adjust the design of REES to optimise its effectiveness and efficiency, including sectoral coverage. We first examine scenarios within the residential sector, and then examine options in the commercial sector, and a combination of the two.

7.1.1 Residential sector

For context, we should note that the pattern of energy savings is expected to change significantly between Stage 1 and Stage 2 of the REES. In Stage 1 (2009–2011), some 50% of the energy savings were derived from lighting improvements (~1.15 million CFLs), while there was a significant contribution of space-conditioning energy savings due in part to the coincidental overlap of REES with the Commonwealth Government's Home Insulation Program. Based on our own modelling, Stage 2 (2012–2014) is expected to show a significant shift towards standby power controllers (~365,000 units), along with a continuation of lighting upgrades (~0.55 million lamps) and showerhead replacement (~49,000).

Generally, the focus of REES thus far, as in Victoria and now in the ACT, has been on simple, easy to carry and install, and low-cost, technology-based solutions. This is both an understandable and appropriate response, as schemes such as REES are in fact designed to allow the market to identify the least cost and preferred solutions. At the same time, it begs the question whether this model would be optimal, or even able to be continued, were the scheme to continue beyond 2014 and with higher energy/greenhouse savings targets.

Our modelling for the period 2015–2020 (referred to as Stage 3) examined four scenarios. These involved a continuation of the current focus on 'quick wins' in the residential sector; two scenarios that reflect a progressive shift to a broader range of energy efficiency solutions in the residential sector (reflecting increasing saturation of the market for current solutions); and finally the addition of commercial sector savings opportunities.

We find that a continuation of the current approach would increasingly run into saturation constraints, as search costs associated with identifying and providing services to those households that have not already received the preferred technology treatments (CFLs, SPCs, shower heads) rise. This saturation effect becomes apparent well before 100% of eligible households have been treated.

In response to this increasing saturation for the currently-preferred solutions, the modelling selects further energy efficiency options in the residential sector, including those that may deliver much larger energy, and hence energy cost, savings per household, but demand a higher upfront investment cost. This would differ from the current 'give-away' business model being pursued by service providers: the higher cost of treatments would mean this would not be cost-effective for service providers (or liable parties), but at the same time, the household would be receiving a large 'free good', delivering significant private benefit to them in the form of avoided future energy costs.

We resolve this dilemma in our modelling by assuming that service providers and liable parties do not continue to provide 100% of the investment (and installation) cost, but rather that they provide a 'voucher' which has the effect of reducing the cost of more expensive upgrades (such as ceiling insulation, hot water system replacement and air-conditioning unit replacements). We assume that the voucher cost would not exceed the equivalent of \$50/t CO_2-e abated, based on the average gross cost of abatement in REES Stage 1 (estimated at around \$44/t CO_2-e).

This particular assumption could be varied – the key point is that householders could choose to contribute to energy efficiency investments, thereby unlocking larger and potentially more cost-effective efficiency outcomes, particularly as the 'give-away' opportunities begin to saturate. Such an approach may require accreditation of suppliers and installers of equipment, although fully qualified and experienced service providers already exist for each of the technologies modelled (which duplicates the list of technologies observed under Stages 1 and 2 of REES). There are also many existing business models, including attractive consumer financing options, already in the market – REES could tap into these opportunities by providing an additional financial benefit only when the consumer chooses solutions that are accredited in advance as delivering significant energy savings. Table 7.1 summarises the results of REES for the period 2015–2020.

Table 7.1 REES Stage 3 (2015–2020) – Potential energy and GHG savings and benefit-cost ratios, residential sector only

	Energy savings (PJ)	Benefit-cost	GHG saving (Mt CO_2-e)	Costs per household per annum (\$)
Scenario 1	7.6	5.9	1.5	14.67
Scenario 2	12.8	4.4	2.5	26.80
Scenario 3	15.7	3.9	2.8	32.90

Scenario 1 is essentially a continuity model with ongoing focus on lighting and standby power, and little additional emphasis on other activities. This scenario delivers modest increases in energy and GHG savings above Stage 2 of REES, but over six years, at essentially the same cost per household.

Scenario 2 assumes maintaining the focus on lighting, standby power and showerheads to saturation levels, while expanding the deployment of other activities (based on the notional $50/ t CO_2-e gross abatement cost metric). The additional activities include ceiling insulation, hot water system replacements, and air-conditioning replacements and substitution for electric space heating. Compared to Scenario 1, energy and GHG savings increase with a decline in the benefit-cost ratio, while there is an increase in the average cost per household.

Scenario 3 recognises saturation by reducing the lighting, standby power and showerhead activities of Scenario 2 while increasing penetration of the other energy efficiency activities across the residential sector in the period to 2020, thereby delivering greater energy savings and GHG savings at a lower benefit-cost ratio, and also a higher annual cost per household. Under the cost and roll-out assumptions applied, all scenarios are highly cost effective and would deliver significant economic benefits for South Australia.

These scenarios indicate, in broad terms, the size of the potential savings pool available and the pay-off from programs that can successfully motivate the adoption of these technologies. Saturation of current activities will require REES to facilitate the uptake of a wider range of energy efficiency activities – a smaller number of larger and more expensive activities. The projected investment paths and accumulation of deemed greenhouse savings (associated with the expected working life of the technologies deployed) is shown in Figure 7.1.

7.1.2 Extending REES to the commercial sector

Commercial operators are not immune to the problem of under-estimating the potential for cost savings through improving energy efficiency in their operations, and bearing higher costs as a result. In a competitive market economy, inefficient businesses come under excess pressure and can ultimately fail, freeing up resources for more efficient business operations. While 'welfare' objectives can be misplaced in a business perspective, there is still a well-defined role for government in addressing systemic barriers to efficient energy choices and resource use. Governments may choose to address these 'market failures' via approaches that differ from those applied to low-income households families, and which are geared to addressing the key barriers to cost minimisation and efficient energy choice.

Preliminary analysis suggests that the scope for enhanced energy efficiency in the business sector is significant, and a significant tranche can be addressed through upgrades to commonly used technologies employed in the built environment. As part of this analysis, we constructed an energy and stock model of existing commercial (or non-residential) buildings in South Australia. The commercial building stock was split into building types to which a number of energy saving measures could be applied. The building types included offices, retail, education, health and hotels. The stock of existing buildings and how that stock evolves in future years, as well shares by building type, were based on previous work undertaken by pitt&sherry for DCCEE.

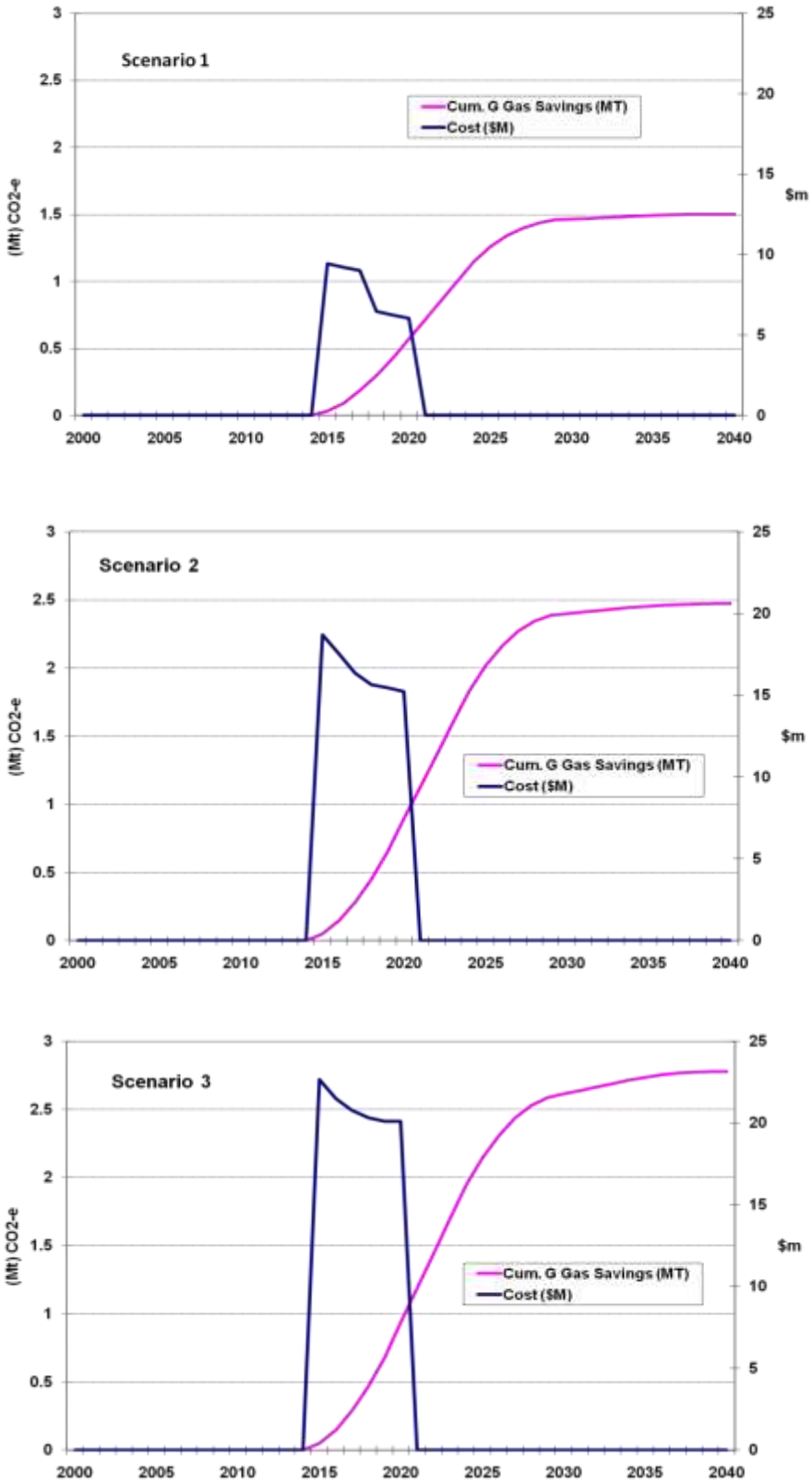


Figure 7.1

Investment costs and accumulated GHG savings from the South Australian residential sector under expanded energy efficiency effort

While there are numerous potential energy saving activities that could be applied to commercial buildings, we modelled activities that have relatively short payback periods (of around 2 to 4 years). Table 7.2 shows the payback in years of a number of end-use energy savings measures as estimated by Energetics at a national level. It is reasonable to assume that these broad outcomes are also applicable to South Australian business operations.

Table 7.2 Payback periods for commercial building technologies

End-use category	Payback in years		Building type	Payback in years
Lighting	2.3	**Shortest**		
Ventilation/fans	2.3		Industrial SME	2.3
Pumps	2.8			
Boilers, furnaces and ovens	2.8		Small trade	3.2
Water heating	3.1			
Refrigeration	3.3		Hospitality	3.4
Appliances and equipment	3.4			
Air compressors	3.7		Small offices	3.9
Heating and cooling	4.0			
Building shell upgrade	4.6	**Longest**		

Source: Energetics

A brief description of the modelled opportunities and their energy saving potential follows.

Control strategies

Controls modifications provide potentially greater savings than any other category or measure. These modifications are often achievable within the existing controls infrastructure and BMS, generally avoiding the need to install a costly full BMS replacement. While the specific controls strategies will vary considerably from building to building, a sample of the most common measures is presented below.

- **TIME OF USE CONTROL**. Perhaps the simplest saving that can be made is by turning off a service when it is not needed. Time of use control modifications include reduced run hours for central plant, and switch-off achieved by using triggered sensors such as occupancy sensors.
- **CONDENSER WATER CONTROL.** Significant savings can be made through modification of condenser water system controls. Examples include modifying the condenser water temperature to track the wet bulb temperature plus three degrees, thereby improving chiller efficiency, and modifications to cooling tower staging or variable speed drives (VSD)s.
- **BOILER TEMPERATURE LOCKOUTS.** Many existing buildings use gas fired boilers. Significant gas and electricity savings are available through locking out the operation of these boilers based upon outdoor air temperature criteria.

- **ECONOMY CYCLE CONTROL**. Many buildings incorporate an economy cycle to increase the quantity of outside air above the minimum when conditions are favourable; however, the methodologies for control can lead to substantial losses of energy. For instance, enthalpy-based economy cycle controls can be based upon a single outside air RH sensor, leading to system failure upon the failure of a single sensor.
- **AIR HANDLER FAN CONTROL**. Considerable energy savings can be made through the optimisation of air handler controls. One suitable method is to reset air handler pressures based between commissioned minimum and maximum pressures, which provides considerable fan energy savings.
- **VSD CONTROL.** Many buildings contain variable speed drives, but with poor, or no configuration. Variable speed drives on pumps and fans can achieve considerable energy savings through reconfiguration.

Improved HVAC maintenance

Lack of maintenance in existing buildings can result in excessive energy consumption. For example poor seating of a heating hot water valve can cause a flow of hot water through the heating coil even when this is not called by the BMS. The unit itself compensates by supplying increased cooling, resulting in the same temperature air leaving the unit.

Upgrades to domestic hot water systems

Substantial energy savings can be made through the replacement of hot water systems with either gas or electric heat pump systems.

Chiller replacement

In climates with significant cooling loads, such as South Australia, the production of chilled water is a significant component of the total energy consumption of a building. Many existing buildings have plant that is dated. Substantial energy savings can be made from the utilisation of high-efficiency, low-load chillers and, in addition, some chiller-related savings can be made from the installation of electronic expansion valves on older chillers.

HVAC variable speed drives

VSDs can be used as an energy saving measure by reducing the speed of fans or pumps. The two primary drivers for the installation of VSDs are for circumstances where a load can be varied, for instance a fan controlled off duct pressure, and for oversized pumps and fans.

In reality, not all of the stock of the building types modelled would have the potential to have the above measures applied to them because they either do not have the equipment/appliances in question, or the measure has already been applied. Estimates on the proportion of building stock for each building type to which measures could be applied, as well as the life of measures, were derived from work undertaken by Energetics (2012).

The savings in electrical energy use and gas energy (where applicable) were calculated to give a total energy savings in for relevant building classes. The take-up of the technical measures is assumed to vary between just 2% of the eligible stock over the 2015–2020 period (for the more expensive chiller replacement measure) up to 20% of the stock for lighting upgrades. These assumptions can be varied within reason, bearing in mind that some of the existing stock will already feature these upgrades and therefore should not be included in the analysis (an estimate of the total stock that the measure could

be applied to is included in the spreadsheet model). On this basis, and even assuming a low take-up rate within the opportunity set, some 4.07 PJ of energy could be saved from the South Australian commercial building stock for measures implemented in the 2015–2020 period, amounting to an emission reduction on projected levels of around 0.6 Mt of CO_2-e. Under a more bullish projection of take-up rates, estimated energy and GHG savings amount to around 11.49 PJ and 1.8 Mt CO_2-e.

In aggregate, these measures are highly cost-effective, with the present value of benefits (around $118.7 million at a 7% real discount rate in the low take-up scenario) exceeding the present value of costs (around $27.3 million under a low take-up assumption) by a factor of 4.3. If a high take-up rate is achieved, the benefits and costs are $319.7 million and $74.5 million respectively (Table 7.3). Details of the modelling and assumptions that underlie the indicated opportunity set are provided in Appendix 2.

The strong benefit-cost ratio suggests that higher savings could be realised cost effectively over this period through more 'aggressive' retrofit strategies than the ones modelled.

Table 7.3 Summary of commercial building energy efficiency opportunities (reflecting adoption from 2014 to 2020)

Results from high EE opportunity take-up rate	
Total cumulative electricity savings (PJ)	6.19
Total cumulative gas savings (PJ)	5.30
Total cumulative energy saved (PJ)	11.49
Total GHG savings over life of measures (Mt)	1.8
Present value of costs (5% discount rate)	$79.16m
Present value of benefits (5% discount rate)	$369.82m
BCR	**4.7**
Present value of costs (3% discount rate)	$84.29m
Present value of benefits (3% discount rate)	$431.05m
BCR	**5.2**
Present value of costs (7% discount rate)	$74.50m
Present value of benefits (7% discount rate)	$319.69m
BCR	**4.3**

While potential for savings through improved lighting energy efficiency is common across households and business, the nature of the lighting and the capital outlay associated with these upgrades can differ markedly. Up front affordability can become an increasing problem for big price tag items – even when quick payback is likely. Differences in leasing arrangements and patterns of building ownership and usage will also affect the scope for businesses of differing sizes and energy needs to capture the full benefit of these equipment improvements. The issue of affordability and investment size can indicate the need for future schemes to target borrowing and technology selection problems, possibly through 'voucher' arrangements, promotion of energy service contract arrangements or other financing innovations.

7.2 Combined residential and commercial savings

Table 7.4 shows the likely impact of extending energy efficiency initiatives (like REES) to the residential and commercial energy efficiency opportunity set – and achieving a high adoption rates for a wide range of opportunities. The analysis suggests that extending and evolving REES to cover commercial and residential opportunities would be likely to be highly cost effective, with a benefit-cost ratio around 4.0 over the period to 2020 (at a 7% real discount rate). That is, $1 of investment in energy efficiency can be expected to deliver around $4 worth of energy savings.

Table 7.4 Benefits and costs of REES (2015–2020 residential and commercial activities, 7% real discount rate)

Sector	Present value of costs	Present value of benefits	Benefit-cost ratio
Residential sector (Scenario 3)	$125.5m	$493m	3.9
Commercial sector (high take-up rate)	$74.5m	$319m	4.3
Combined residential and commercial sectors	$190.5m	$753m	4.0

7.3 Design considerations for extending REES

This section recalls the more generic discussion in Section 6 (with respect to the range of potential scheme design options identified in the terms of reference for this study, by stakeholders or by the review team) and applies those perspectives to a possible REES Stage 3 over the 2015–2020 period.

As noted above, we believe that the REES design would need to evolve if it were to be continued beyond 2014. The key reasons for this are the prospect of increasing saturation of 'give-away' technologies in targeted South Australian households, declining 'additionality' of savings from these devices as policy and market settings continue to change, along with increasing search and compliance costs. We note that both the Victorian and New South Wales schemes have evolved in the direction of wider sectoral coverage and higher energy/greenhouse savings targets. Further stakeholders other than retailers supported continuation and extension of the scheme.

If the South Australian Government wishes to pursue the next echelon of energy efficiency gains (and the net cost savings that these entail over a reasonable time frame) an approach more closely targeted at 'top up' funding requirements and overcoming borrowing constraints is recommended. Bigger costs and the potential for bigger savings also suggest the likelihood of greater 'mainstreaming' of energy efficiency as a focus for decision making for both households and the private sector. This implies a need for targeted approaches that more directly address market failures that lead to poor technology choice and energy use outcomes. These relate to:

- inadequacies in information or uncertainty relating to available gains energy performance;
- an inability to fully capture the benefits from investments in efficiency improvements;
- cash constraints and difficulties accessing finance.

We note that there is nothing in the current REES design that would prevent the 'top-up' approach emerging as a natural response to the market factors noted above. However, in the absence of such an approach, an argument could be made that the total costs associated with meeting higher targets would rise strongly. Therefore it would be in the government's interest to embed this lower cost approach within this scheme. As it would represent a qualitative change from the current REES approach, it may be appropriate to support the roll-out of an altered design, post-2014, with an appropriate communications campaign designed to promote transparency around the energy efficiency opportunity set, and encourage greater private sector innovation and take up around provision of energy services and the enhance penetration of energy efficient technologies that can deliver significant cost savings and performance benefits to users.

Appendix 1

Summary of submissions to REES stakeholder discussion paper

Please note that the subsection numbering refers to the relevant section of the Stakeholder Survey. Comments are generally summarised, with detail as necessary.

A Retailers

B Consumer groups

C Other

D Business

A Retailers

AGL / Powerdirect

4.1 Independent evaluation

Services available through REES are not supported outside REES. Consumers face cost and information barriers that could be better addressed through longer term relationships. The current scheme has boom/bust cycle following technology changes. A supportive pathway is needed to deliver behavioural changes (e.g. starting with an in-house display (IHD)). The review should consider the concept of 'bonus credits', when further activity (eg. purchase of efficient appliance) arises from initial activity (eg. audit). There is a need to review overall costs, in particular recognising the additional cost of installation requirements, linked to requirement for proof of installation. Perhaps alternative approaches could be found, including option of self-installation for some technologies? A further issue relates to the potential to switch from a deeming values approach to the actual performance of an item - which could be supported by an energy performance contract. Another approach would be to consider discounts on a wider range of appliances (e.g. TVs) where energy efficiency is not normally a factor. Finally, the current prioritisation could be extended beyond the current priority target to householders on retailer hardship programs or with demonstrably high consumption – use of a multiplier would encourage deeper assistance.

4.2 Householder survey

The survey can provide insight into consumer perceptions, but its usefulness could vary. Suggest questions be developed in relation to preparedness to pay - how much? payback period?; level of understanding and confidence in audit report; and whether, in the absence of audit report follow up, interest-free finance would have made a difference. Goal should be to determine whether there are greater benefits available from audit and access to energy efficiency activities.

5 Scheme objectives

The scheme should have a broader focus on education in longer term partnerships, with clear policy goals beyond REES itself - expressly linking REES to other government schemes to avoid costs of inconsistencies, and addressing peak load issues. There should be consideration (in consultation with utilities) of activities linked to load shifting as well as energy saving to recognise all components of the total cost of energy.

6.1 Application of regulations

The 5,000 customer threshold is appropriate only if there is no extension to large customers. With such expansion without removing the threshold, retailers not subject to obligations would have an incentive to cherry-pick large customers. Expansion to include SMEs is supported, as they are generally larger customers then residential customers, with similar impediments to taking up energy efficiency. This would also be consistent with other state schemes.

6.2 Interpretation of regulations

The priority group is defined around holding or being eligible for defined concessions, generally based on income. Consideration needs to be given to expanding the target to include large families, receipt of Family Tax benefit, and preferential consideration of high consumption relative to income within target groups, again with multiplier benefits to retailers. The certainty of targets and gradual increase in targets have helped retailers build energy efficiency businesses, and any change using more up to date

data should preserve the element of certainty in targets. The South Australian scheme is superior to the states where targets have increased more aggressively. Option for move to ESS-type target (reductions from baseline attributed to retailer's actions) should be investigated.

6.3 GHG reduction targets

REES is energy efficiency scheme, so more appropriate to measured avoided energy consumption. In terms of regional and remote targets, multipliers or self-installs are needed to encourage uptake for these targets. Overall, REES needs a better balance between process driven and outcome based compliance. REES is strong on prescription, but not on measuring outcomes. An example is standby power controller with high take up but little abatement, and IHDs could deliver similarly modest outcome. More focus is needed on outcomes.

6.5 Energy target audits

Audit target as number of audits delivered does not adequately value potential behavioural changes delivered. Suggested that a deemed credit be available for unknowable results of audit. Beyond audit numbers, there could be a case for fewer, more comprehensive audits which could be expected to have greater behavioural change potential, though new indicators would be required to monitor such an approach.

6.6 Administration

Effective and efficient administration has been provided by ESCOSA, with prompt responses and updating of guidelines.

6.7 Notification and adjustment of targets

Current provisions operate effectively.

6.8 Energy audits

Preference for NSW ESS approach for a measured baseline and then achieved reductions are attributed to retailer actions. The 10% tolerance for energy audit shortfalls is appropriate.

6.9 Energy efficiency activities

REES focus needs to switch to building longer term relationships with customers - through mechanisms like EPCs (Energy Performance Contracts) - to encourage longer term relationships (and behavioural change). Retailers would have more incentive to invest time in a long term customer. Such an approach would link with the baseline and reduction approach of ESS. Inclusion of IHDs and similar technology is supported to empower consumers and underpin longer term relationships, with benefits credited via a deeming methodology (deeming value determined by measurement of a control group). There is a benefit to directly linking audits and activities - enhanced outcome for householder with information and action, though not all audits result in need for activities. The current approach of linking activities to address rather than account holder is satisfactory, and change would lead to additional complexity. As activities become more expensive there is a risk that products may be moved to a new address.

6.10 Energy efficiency activities for priority group households

The 35% target is sufficient, though retailers should be able to refer their own hardship customers for assistance under REES. These are generally high need households, and multipliers could provide incentives to address such households, while producing a greater level of activity. Better coordination of government programs would be supported, but direct government involvement is not necessarily

expected. Higher priority groups could be targeted most/first, and the retailer hardship program should be in top ranked group.

6.11 Determination of energy efficiency activities

REES deeming methodology is very conservative, and can follow other state deeming values, with the result that an additional risk element is added at each step. Changing to measurement of avoided energy consumption, rather than carbon reduction, would improve methodology. Concern that deemed energy efficiency improvements may not accurately reflect actual results, and recommendation for study to verify actual outcomes. The current determination process fails to encourage innovation, though it is important to maintain a balance between new products and standards for energy efficiency improvements. There is a danger that identification of particular brands can lead to monopoly situations, with loss of the price benefits of competition. Delays have occurred for activities due to the once per year window for new products coupled with the timeframe for the determination of the deeming value - more frequent applications for new products are supported. There is a perception that there is a lack of independent consultants for determination of the deeming process.

6.12 Retailers' arrangements

The current model is adequate for the size of REES, as there is insufficient liquidity in the scheme to support a formal trading model. The controls in place over energy services contractors are adequate.

6.13 Compliance and reporting – the REES Code

More timely reporting of REES activities would benefit retailers by assisting better planning and cost management for meeting target. Other states provide real time information.

6.14 Energy efficiency shortfalls

The penalties are high compared to other state schemes, and provide strong incentives for compliance.

7 Consumer protection

As noted in Section 6.10, prioritisation is supported, but with the inclusion of retail hardship lists. The scheme objective should include the development of a private market for energy efficiency services beyond REES itself.

8 A National Energy Savings Initiative

Transition to a national scheme should involve a specified proportion of tradeable certificates. While a transition would be lengthy, there would be benefits. A national scheme should contain only very limited state derogations (i.e. minimum volumes per state) to limit administrative and compliance costs.

9 National consistency

Support for NESI with tradeable certificates, targeting energy reduction and cost efficiencies. Expansion of REES to SMEs is supported.

10 Complementarity to a carbon price

Support for maintenance of GHG objective in REES to complement carbon price. Carbon price drives some behaviours but less effectively than specific focus on delivering energy efficiency services.

11 Funding

Support for current funding model.

12 Communications and public awareness

Retailers and government should jointly promote REES and build awareness. Some issues are retailer specific, but community should be aware of government policy. As the REES focus is on priority groups, there needs to be better communication via the other government contact points typical for such priority group households. There is always a risk with free services that will be demand exceeds supply. All REES stakeholders need to work toward situation were audits and services are valued through a market for energy efficiency industry services beyond REES.

Origin Energy

4.1 Independent evaluation

Agree with proposed scope, plus addition of transition to national scheme.

4.2 Householder survey

Consumer views on alternative energy efficiency measures and audits, including IHD

5 Scheme objectives

If REES is to continue, objectives should be extended to ensure that measures/audits have BCR>1. Economics must be clear to all stakeholders when moving beyond low cost (e.g. CFLs) options.

6.1 Application of regulations

Extension to SMEs is not supported because competitive incentives and other measures are available. Increased compliance costs would exceed benefit. Recognition that scope for expansion in residential is reducing so extension to SMEs may be only way to meet targets after 2014. Thresholds not supported in that they distort competition. Continuation of REES NOT supported.

6.2 Interpretation of regulations

Current terms and definition are fit for purpose, but nationally consistent approach would be better.

6.3 GHG reduction targets

Alternative approaches are difficult to measure and may have unforseen costs. Triennial target setting is appropriate to provide accurate retailer targets and support planning and delivery of work to meet targets. Specific targets for regional/remote will substantially increase costs - need government subsidy.

6.4 Percentage of target delivered to priority group households

Focus on priority group may reduce ability of REES to assist those in greatest need - diverse range of households, some with very low energy consumption. Marginal cost of energy efficiency is higher for smaller customers, reducing REES outcomes. No support for changes because of possible incorporation in national scheme. Inconsistency between activities allocated to priority group and numbers in numbers in priority group - reduce priority activities to 30%

6.5 Energy target audits

Support for triennial target setting. Technology solutions (e.g. Origin Smart - internet portal) potentially more cost effective and sustainable than simple audit.

6.6 Administration

Efficient and effective, with collaborative approach from ESCOSA staff.

6.7 Notification and adjustment of targets

Adjustment of targets and application of credits have operated effectively.

6.8 Energy audits

Existing approach should remain until review examines effectiveness of current approach. Increases in auditor training and expanding detail in audits will increase costs. The shortfall tolerance for audits of 10% should remain.

6.9 Energy efficiency activities

Recording and management is effective. Focus on limited activities reflects retailer focus on acting cost-effectively and minimising REES cost while delivering objectives. IHD and energy management controllers can play an important role in facilitating demand response, but lack of smart meters in South Australia limits the scope of subsidiary technologies.

6.10 Energy efficiency activities for priority group households

See response to Section 6.9. Separate program for priority group households not supported. Concern that changes would complicate administration, especially if targeting small number of customers, and add disproportionately to cost.

6.11 Determination of energy efficiency activities

Any program relying on deemed values will always have an element of artificiality that cannot be avoided - audit or technology installation is no guarantee of lasting impact. Market based approach via carbon price provides an ongoing signal to consumers.

6.12 Retailers' arrangements

Although Origin does NOT support REES, recognition that a trading mechanism similar to NSW and Victoria would contribute to flexibility.

6.13 Compliance and reporting – the REES Code

No problems with compliance and reporting.

6.14 Energy efficiency shortfalls

Penalties are considerable, and appear to be effective to ensure compliance with REES.

7 Consumer protection

Unaware of systemic issues associated with REES service providers or customers who contact Origin. Support for service providers to carry fact sheet to make clear the program is driven by government GHG policies. This should improve trust and acceptance by consumers, and improve uptake of REES.

8 A National Energy Savings Initiative

Query value of national scheme - national carbon market more appropriate. The nature of REES-type schemes is that the pool of meaningful activities diminishes over time, so costs increase as net benefit decreases. Most important measures in future will be demand responses enabled by smart meters (IHD, etc) and consequent behavioural change.

9 National consistency

If REES is to continue, tradeable certificates would lead to national consistency and more flexibility. Expansion to SMEs is not supported, but beyond 2014 this may become necessary to meet targets.

10 Complementarity to a carbon price

REES should cease with adoption of national carbon price. Single national approach delivers a better policy outcome - complementary jurisdictional schemes should be avoided.

11 Funding (Section 11)

If REES is to continue beyond 2014, continuation of the current funding model is supported. Any changes to the scheme will involve additional administrative costs for recovery through regulated tariffs.

12 Communications and public awareness

No need to increase awareness, as REES in mature and final stage. If it continues, REES fact sheet would assist service agents by making government role clear. National carbon market will support growth of private markets for energy efficiency services.

Alinta Energy

5 Scheme objectives

While REES has been successful in meeting original objectives, the costs to customers of extending beyond 2014 are unlikely to out-weigh benefits, and the scheme should end. There is a case for ending earlier so that utilities with initial obligations in 2013 do not have to comply with high upfront costs for a scheme of limited duration. Other schemes introduced since 2009 are addressing REES policy objectives, and maintaining REES will provide little marginal benefit - with onerous obligations and high costs imposed on the industry, which are ultimately passed to consumers.

6.1 Application of regulations

Alinta will first incur obligations in 2013 - non-core activities that may only be relevant for 2013 or 2013/2014 depending on the REES review outcome. Significant upfront costs will be required to cover obligations over a possible short term. Alinta seeks exemptions from such obligations.

6.12 Retailers' arrangements

REES is particularly burdensome compared to other states because it is not a tradeable scheme, and requires retailers to engage directly or indirectly in non-core activities. The REES priority groups add a further compliance burden. Many of the low cost energy efficiency options (e.g. CFLs) have been exhausted and remaining options are more expensive.

Simply Energy

5 Scheme objectives

No support for continuation of REES beyond 2014. REES is not cost effective, as demonstrated by the ESCOSA analysis, nor does it meet its own stated objectives. It is no longer relevant to prepare consumers for price increases resulting from emissions trading. REES has been effective in delivering lowest cost energy efficiency activities, through generally free and quick and simple activities. However, these activities are approaching market saturation, and increasingly expensive activities will need to be undertaken to meet retailer obligations. Consequently, all consumers will face higher costs, with disproportionate impacts on low-income households. If the scheme must continue, recommendations to limit the cost to consumers are provided under relevant headings.

6.1 Application of regulations

No support for expansion beyond the residential sector on the basis that REES cannot be justified where it does not deliver cost effective energy efficiency improvements above the level that would occur under a national carbon pricing scheme. Although household energy efficiency activities are relatively straight forward, management of energy efficiency service providers is onerous. Energy efficiency improvements for SMEs and industry would need to be tailored to individual businesses and therefore more onerous with substantially increased compliance costs. In addition, there is support for removal of the 5,000 customer threshold for being an obliged retailer under REES on the basis of competitive neutrality. The ESS operates with a threshold (liability to all retailers) and, although a threshold applies under VEET, it is claimed that this leads to competitive distortions, particularly for expansion beyond the residential sector (e.g. cherry-picking of larger SMEs).

6.3 GHG reduction targets

No support for multipliers or bonuses in regional/remote areas which would distort market. Multipliers make quantification of outcomes more difficult, as well as leading to boom/bust cycles as has been the case for the solar credits multiplier under MRET.

6.10 Energy efficiency activities for priority group households

The 35% target is not supported - such targets increase cost and complexity of compliance. Note that Brotherhood of St Laurence study of VEET supported substantial energy efficiency improvements in low-income households without ring fencing. The 35% target splits the total market, increases costs for overall REES outcomes. As low cost activities reach saturation, and upfront cost contributions increase, uptake from low income households will fall. Consequently the costs for the priority group will increase, with higher compliance costs for retailers, and higher energy prices for consumers, including low income consumers less able to support upfront costs. It is noted that removal of the priority group target is suggested in the Issues Paper in the context of the Commonwealth Home Energy Saver Scheme, which has a broader focus than REES for support of low income households.

6.12 Retailers' arrangements

Under the current approach retailers are responsible to ESCOSA for all REES obligations. This is not core business for retailers, who generally engage specialist suppliers, at some risk, as the retailer remain ultimately responsible for the services. Assurance of compliance is onerous and time-consuming. Service providers can only participate in REES through a contract from an obliged retailer, and consequently, the range of products and services offered and geographical areas serviced are limited. These factors limit customer access to REES and reduce supply of REES activities and audits, driving up the price for services and total costs to consumers. It is recommended that ESCOSA introduce service provider accreditation, as occurs under other state schemes. Retailers would then commission only accredited providers to undertake REES activities - service providers could report outcomes directly to ESCOSA, and ESCOSA would assess compliance directly with providers. ESCOSA would maintain a register of providers for consumers and obligated retailers. The benefits of such an approach are significant because of a greater

number of participating businesses: greater supply of REES activities; more competition and lower costs; broader range of activities and products; and improved consumer access (particularly in terms of geographical spread). This model would allow participation of community NGOs in REES, linking REES to other activities undertaken to support low income households. Some additional costs for ESCOSA would be involved, but mechanisms exist to pass these to all consumers in an analogous manner to the current compliance costs of retailers. A second recommendation relates to making REES a certificate-based scheme. Currently, the units of REES credits are tonnes of CO_2-e and numbers of audits, but they are not registered property rights. Retailers submit activity/audit data to acquit liability and after compliance checks by ESCOSA the data may be accepted or rejected. This leads to contracted over-supply in case of retrospective shortfalls. While regulations allow trading of obligations this rarely occurs because the REES activities and audits are not registered credits, which adds risk as commercial agreements may make it difficult for a receiving retailer to confirm compliance, and trading is only likely when a surplus is available, but this will not be known until late in the year. Without trade there is no price transparency for REES activities and audits so that contracting parties do not know whether terms reflect supply and demand. Similarly, ESCOSA is impacted in the context of making regulatory decisions. It is recommended that the registration of REES activities and audits defines discrete property rights or certificates, which can be traded as in other states. Once compliance of activities were validated as certificates market trading could occur without compliance responsibility. A registry would be required to manage and track certificates. The key benefit is a transparent market to help reduce overall REES cost.

6.14 Energy efficiency shortfalls

Penalties are the highest of all jurisdictions with both variable and fixed components. It is suggested that the size of the penalty should be viewed as a mechanism to cap the cost of REES to consumers 'because the shortfall charge acts as a ceiling to the contracted price of REES activities and audits'. The high penalty means the scheme cost becomes high before a shortfall is reported.

8 A National Energy Savings Initiative

NESI supported, subject to removal of all state schemes. Industry must be consulted on any transitional arrangements from REES to future NESI.

B Consumer Groups

UnitingCare Wesley Country South Australia

4.1 Independent evaluation

Query energy audit numbers in regional areas. Compare cost of REES interventions with previous program (EEPLIH).

4.2 Householder survey

Ensure 30% of returns from regional areas.

5 Scheme objectives

Revise to ensure no disadvantage to regional consumers. Revise to ensure low income group is 65% (not 35%) target.

6.1 Application of regulations

Current focus OK, no expansion to small business as many other programs for energy efficiency for SMEs.

6.2 Interpretation of regulations

Priority group more easily identified if frontline service fore audits is NGO that provides anti-poverty services. NGOs have multiple contacts already and engage on utility issues. Priority group needs specific regional and remote targets

6.3 GHG reduction targets

GHG target should be maintained. Additional specific targets by South Australian region and with priority targets by region are needed. Current low performance in regions reflects commercial environment of service supply, not demand

6.4 Percentage of target delivered to priority group households

Increase priority target to 65%, with regional quotas.

6.5 Energy target audits

Eligibility is adequate. Concern if influenced by retailer hardship programs - policy variations not good basis for sound policy or service delivery. NGOs have no such conflicts, and are better placed to identify and support priority groups. More than one audit visit is needed and can align with ongoing financial counselling.

6.7 Notification and adjustment of targets

Regional needs and priority groups within regions need to be reflected in targets.

6.8 Energy audits

Verification often difficult in low income households, due to other issues (mobile group, rental accommodation, etc). Interventions beyond audits needed to achieve outcomes with higher level interventions to empower households. Pilots such as Low Income Energy Efficiency Program can provide more accurate metrics for measuring energy savings.

6.9 Energy efficiency activities

Limited range of activities in REES is reflection of commercial environment for REES service delivery. Wider activities could be undertaken in NGO environment. Could link activities to person not address with mobile population.

6.10 Energy efficiency activities for priority group households

Recording of energy efficiency activities to priority group is inadequate - regional priority group not measured. REES should be integrated with other schemes (e.g. NILS) to ensure service delivery is not confused by commercial operations of retailers.

6.11 Determination of energy efficiency activities

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6.12 Retailers' arrangements

REES should be seen as part of safety net support for low income householders with partnerships between retailers and Not-for-Profits. Future links with Commonwealth HESS and LIEEP.

6.13 Compliance and reporting – the REES Code

Online CRM data system would address such issues - requires ESCOSA investment. Such tools already used by Not-for-Profits.

7 Consumer protection

Many issues raised relate to commercialisation of REES activities. Alternative approach through Not-for Profits allows welfare and utility issues to be jointly supported with a state-wide approach and integration of State and Commonwealth programs .

8 A National Energy Savings Initiative

Lack of coordination of alphabet soup of Commonwealth (LIEEP, CEEP, HESS, NILS) and State (REES, EEFI, Counselling) for residential energy efficiency programs, with varying requirements/changing regulations, contracting arrangements, lack of consultation between departments and coordination of timing of service delivery. Coordinated approach for low income households should be developed to ensure sound and sustainable service delivery.

9 National consistency

No expansion to non-residential sector, with delivery removed from retailers

10 Complementarity to a carbon price

REES still relevant.

11 Funding (Section 11)

REES to continue, with funding from retailers, but not responsibility for service delivery. Much wider range of services beyond audits and retrofits. REES needs a new approach with more innovative solutions (e.g. loans, rebates, new technology). More coordinated government approach to achieve results with utility generated income.

12 Communications and public awareness

Fully integrated REES for priority group would work better through welfare NGOs, where daily contacts lead to a more effective promotion and delivery of energy efficiency information and services.

Conservation Council SA

5 Scheme objectives

Support for continued requirement for retailers to achieve targets relating to both greenhouse savings from energy efficiency and a specified number of energy audits. Broadening the scheme for more customers would require additional actions and targets, with a focus on willing participants and cost effective and affordable solutions. Targeting peak demand reduction and load smoothing also supported.

8 A National Energy Savings Initiative

Support for REES to be maintained and harmonised with NESI, while ensuring complementarity with other government schemes. Concern over proposal to remove emission reduction as one of the key objectives of NESI - REES should maintain co-objective of emission reduction.

Energy Consumer Council

5 Scheme objectives

Support for load smoothing, including smart meters and TOD pricing.

6.4 Percentage of target delivered to priority group households

Broaden scope of energy stressed targets

6.5 Energy target audits

Broaden scope of energy stressed targets

8 A National Energy Savings Initiative

REES maintained and harmonised with NESI, with both energy and emissions reduction targets.

10 Complementarity to a carbon price

Concern over abandonment of climate change policies due to interpretation of COAG complementarity principles. The focus on energy and GHG as additional action by householders to reduce emissions is needed beyond the action of carbon price alone.

South Australia Council of Social Services

5 Scheme objectives

Continue REES until NESI is in place. Put future emphasis on system load.

6.4 Percentage of target delivered to priority group households

Benefits not equally shared with regional and remote consumers.

6.5 Energy target audits

Benefits not equally shared with regional and remote consumers.

6.8 Energy audits

Longer/multiple audits to enhance behavioural change in low income households.

9 National consistency

Support for NESI focus on load. State targets still needed to ensure South Australia is not disadvantaged by a NESI focus on targets already saturated in South Australia.

Uniting Communities

4.2 Householder survey

Specific target for number of low income households in survey to ensure experiences are captured.

5 Scheme objectives

Support for addressing peak load issues. Impact of efficient active and/or passive heating and cooling enables a greater contribution to reducing peaks. New long term program to address poorer housing stock of low income households.

6.4 Percentage of target delivered to priority group households

Regional areas under-represented, despite greater temperature extremes. Priority group target maintained at 35%, as minimum.

6.5 Energy target audits

Prior to HESS, requests for audits could not be satisfied. Retailer strategies for REES availability means inequitable outcomes for some households. Early intervention with utility bill stress is most effective, but if householders chose to go without other essentials, they may never qualify for retailer hardship programs. A broader definition of eligibility could be used to address problems before current criteria were satisfied.

6.8 Energy audits

Longer audits with focus on understanding how house is operated. Audits on low income households conducted without access to many retrofit options, so that audits should focus on behavioural change.

6.10 Energy efficiency activities for priority group households

Resources available such for activities are limited. Commonwealth and State schemes should be coordinated.

8 A National Energy Savings Initiative

Support for state targets remaining even with NESI. Continuation of REES until NESI implemented.

10 Complementarity to a carbon price

Strong argument for REES and other energy saving schemes to reduce costs.

11 Funding

Need to avoid REES costs to consumers becoming a burden to low income households.

David Whiting Energy Solutions

4.2 Householder survey

Increase target number of households to more adequately reflect the needs of the priority group.

6.2 Interpretation of regulations

There is scope to widen the priority group with further specified sub-groups, which broadly comply with the needs of current target groups, but have barriers that reduce the likelihood of being identified as needing an audit. A list of such additional target characteristics is identified.

6.8 Energy audits

Incentive plan for auditors to deliver more individualised/longer energy audits, with a focus on behavioural change. Follow up visits and use of subsequent energy bills to identify reductions in GHG emissions could be incorporated in REES targets. Incentives should be provided for energy audits for rural and remote areas. The major issue is additional travel costs, as very few auditors are based outside Adelaide. A further element is audit identification of poorly performing refrigerators/freezers, and subsidies for disposal of such poor appliances in rural and remote households which can take advantage of No Interest Loans Schemes (NILS). These are routine in the city but expensive in remote areas.

C Other

Housing South Australia – Asset Services (Department for Communities and Inclusion)

5 Scheme objectives

REES already has provision to upgrade (non-ducted) cooling systems and education through audit.

6.1 Application of regulations

Retain focus on residential consumers. Fee for service approach could be used for SMEs.

6.3 GHG reduction targets

Feedback from regional offices and tenants indicates that REES has limited availability outside the city, and incentives are needed.

6.5 Energy target audits

Need to broaden audit targets to pick up more utility hardship program participants, not all of whom are concession customers.

6.9 Energy efficiency activities

View that benefit to priority group households if there was a referral process to the Home Energy Saver Scheme and access to No-Interest Loans to assist implementation of audit recommendations.

8 A National Energy Savings Initiative

Targets for priority group households and state-based targets should remain in a national scheme to ensure continued energy efficiency benefits for South Australia.

12 Communications and public awareness

Retailers have direct access to customers, and should promote REES with utility bills, and also improve awareness among their own call staff.

D Business

Business South Australia

6.1 Application of regulations

Support for extension of REES to SMEs and commercial landlords to mitigate problem of mixed incentives in landlord-tenant relationship. For SMEs, many of the energy savings are similar to households.

6.3 GHG reduction targets

Primary focus should be reduced energy consumption and reduced energy costs.

8 A National Energy Savings Initiative

Preference for national scheme, that includes business community. Extended REES or NESI should include tradeable energy saving certificates to deliver more efficient outcomes.

South Australian Farmers Federation

6.1 Application of regulations

Support for extension of REES farming operations, especially those with high energy uses (e.g. dairy, irrigation)

6.4 Percentage of target delivered to priority group households

Need to increase focus on low income families in regional areas, including farms. Some weighting required to provide incentives, and more concentrated local promotion through country councils and rural press/radio.

6.8 Energy audits

Problems identified with audit processes (e.g. poorly trained cold-callers, no audit but signature in exchange for light bulbs, no real education that could lead to behavioural change).

12 Communications and public awareness

For regional areas need more concentrated local promotion through country councils and rural press/radio.

Appendix 2

REES telephone survey questionnaire for audited households and those benefiting from appliance retrofits (March 2013)

Relating to energy audit activities						
1	How much time did the auditor spend reviewing your household appliances and energy use?	Less than 5 mins	5-15 mins	15-30 mins	30-60 mins	More than 60 mins
2	How much time did the auditor take to explain their findings and recommendations to you?	Less than 5 mins	5-10 mins	10-15 mins	15-20 mins	More than 20 mins
3	Did you receive a follow-up visit or phone call from the auditor after the audit?		No	Unsure	Yes	
4	How helpful was the follow-up visit or phone call ?	Very unhelpful	Unhelpful	Neutral	Helpful	Very helpful
5	How many energy saving actions did the auditor recommend or suggest to you?	None	1 or 2	3 to 5	6 to 10	More than 10
6	How many of the recommendations or suggestions did you act on?	None	A few	About half	Most	All
7	For those recommendations and suggestions that you didn't act on, what were the main reasons you didn't act? You can select more than one.	Too expensive	They were too difficult to do	I had other priorities/ too busy	They were of no benefit to me	Other reasons
Write other reason here:						
8	How happy were you with the overall quality and reliability of the audit service?	Very unhappy	Unhappy	Neutral	Happy	Very happy
9	In your view, how much impact has the energy audit had on reducing your household energy use?	None or negative	Very small	Don't know or haven't noticed	Moderate impact	Big impact
Relating to energy efficiency activities						
10	Were the energy saving products actually installed by the person who visited your home, or simply handed over?	Handed over		Mixture of both		Installed

11	If installed, how happy were you with the quality of the job?	Very unhappy	Unhappy	Neither happy or unhappy	Happy	Very happy
12	If these products were not provided to you through the scheme, how likely is that you would have purchased them anyway within the next 6 months?	Very unlikely	Unlikely	Possible/ neutral	Likely	Very likely
13	(IF APPLICABLE) How often are you using the energy saving light globes provided?	Not using them at all	Using them in rooms that rarely need lighting	Using them in rooms that occasionally need lighting	Using them in rooms that regularly need lighting	All rooms
14	(IF APPLICABLE) How would you rate your satisfaction with the energy saving light globes provided?	Very low	Low	OK	High	Very high
15	(IF APPLICABLE) Where are you using the energy saving showerhead/s provided?	Not using them at all	In a shower that is rarely used	In a shower that is occasionally used	In a shower that is regularly used	In all showers
16	(IF APPLICABLE) How would you rate your satisfaction with the energy saving shower head/s provided?	Very low	Low	OK	High	Very high
17	(IF APPLICABLE) Where are you using the energy saving standby power controller provided? (CAN TICK MORE THAN ONE)	Not using them at all	Connected to computer equipment used regularly	Connected to audio-visual equipment used regularly	Connected to computer equipment rarely used	Connected to audio-visual equipment rarely used
18	(IF APPLICABLE) How would you rate your satisfaction with the energy saving standby power controller provided?	Very low	Low	OK	High	Very high
19	In your view, how much impact have these energy saving products had on reducing your household energy use?	None or negative	Very small	Not sure	Moderate impact	Big impact

Relating to attitudes					
20 Did the home energy audit and/or energy saving products you received lead you to undertake extra energy saving activities?	No		Didn't notice/ neutral		Yes
21 [IF YES] How much energy do you expect to save from these extra activities?	None/ negative		Unsure	A moderate amount extra	A lot extra
Overall ratings					
22 How would you rate your overall experience with this scheme?	Very poor	Poor	Fair	Good	Very good
23 Do you have any final comments on the Scheme or its performance?	Write comments				

Appendix 3

Modelling energy efficiency opportunities in the commercial sector

Take-up rates of each measure were applied to the floor area of the applicable building stock in order to estimate the total energy savings that accrues over the period. Based on estimates of the average size of each building type, a weighted average size of all relevant stock was also calculated. As a result, the number of buildings taking up a particular measure in each year was estimated based on the take-up rates being applied to applicable floor area.

Table 1 shows that depending on the measure, the number of buildings treated annually ranges from 2 to 32, and 12 to 65, in the low and high take-up rate scenarios, respectively. It can be seen that even under the high take-up rate scenario, the number of buildings that each measure is applied to in each year is relatively modest. While it should be noted that estimates of average building size were based on limited data and therefore may not reflect reality accurately, it remains likely that the number of buildings the measures apply to is relatively low.

Table 1 Commercial buildings: assumed measures and take-up rates

Energy saving measure	Low take-up (2015–2020)		High take-up (2015–2020)	
	Take-up rate	Estimated number of buildings treated annually	Take-up rate	Estimated number of buildings treated annually
Improved HVAC control strategies	10%	13	30%	40
HVAC maintenance	10%	8	30%	24
Improved domestic hot water	10%	12	30%	38
Chiller modification or replacement	2%	2	10%	12
Pumps/fans with VSD	10%	6	30%	17
Improved lighting controls	20%	32	40%	65
Reduced lighting density	20%	32	40%	65

These take-up rate assumptions can be varied within reason, bearing in mind that some of the existing stock will already feature these upgrades and therefore should not be included in the analysis (an estimate of the total stock that the measure could be applied to is included in the spreadsheet model).

Table 2 shows that the under the low take-up rate scenario deemed energy savings average around 680 TJ annually with about 0.1 Mt GHG emissions be avoided annually. This equates to a total 0.6 Mt avoided GHG emissions between 2015 and 2020 (noting that these are deemed GHG savings and the actual avoided GHG emissions over the period would be less).[7] Under the low take-up rate scenario the amount of energy saved annually in the commercial building sector reaches 2% in 2018–2020.

[7] For the purposes of modelling the take-up rate was averaged over the 6 year period to provide an annual figure which was then applied to the evolving 2015 building stock. This stock declines over time due to demolitions and refurbishments, thus the annual deemed energy savings is shown to decline from 2015 – 2020. In reality, take-up rates are likely to increase each year resulting in increasing annual deemed energy and GHG savings. In any case, the total deemed savings over the 2015–2020 period would be the same.

Table 2 Annual deemed energy and GHG savings, all measures (low take-up)

	2015	2016	2017	2018	2019	2020
Electricity (TJ)	4234	407	391	375	360	348
Gas (TJ)	325	312	300	288	276	265
Total energy (TJ)	749	719	691	663	637	613
GHG (Mt)	0.1	0.1	0.1	0.1	0.1	0.1
% cumulative energy saved in commercial buildings (low take-up)	**0.49%**	**1%**	**1%**	**2%**	**2%**	**2%**

Table 3 shows that under a high take-up rate scenario annual deemed energy savings average around 1916 TJ, about 2.8 times higher than under the low take-up rate scenario. Annual avoided GHG emissions increase to about 0.3 Mt annually which equates to 1.8 Mt avoided GHG emissions between 2015 and 2020. Under the high take-up scenario, energy savings in the commercial building sector increase to 7% in 2020.

Table 3 Annual deemed energy and GHG savings, all measures (high take-up)

	2015	2016	2017	2018	2019	2020
Electricity (TJ)	1139	1093	1050	1008	967	935
Gas (TJ)	976	937	900	864	829	796
Total energy (TJ)	2115	2031	1949	1871	1797	1731
GHG (Mt)	0.3	0.3	0.3	0.3	0.3	0.3
% cumulative energy saved in commercial buildings (high take-up)	**1.34%**	**3%**	**4%**	**5%**	**6%**	**7%**

All measures are cost effective, with some far more cost-effective than others. HVAC maintenance and improved HVAC control strategies are very cost effective with benefits exceeding costs by a factor of around 10. Upgrading the lighting (i.e. reduced lighting density) is also very cost effective. The least cost effective strategies are improved domestic hot water systems and chiller modification/replacement (Table 4).

In aggregate, these measures are highly cost effective, with the present value of benefits exceeding the present value of costs by a factor of over 4. The strong benefit-cost ratio suggests that higher savings could be realised cost effectively over this period through more 'aggressive' retrofit strategies than the ones modelled.

Table 4 Benefits/costs of commercial building measures

Benefit-cost ratios (@ 7% discount rate)							
Improved HVAC control strategies	HVAC maintenance	Improved domestic hot water	Chiller modification/ replacement	Pumps/fans with VSD	Improved lighting controls	Reduced lighting density	Aggregate of all measures
9.0	10.0	1.8	2.2	6.2	3.4	6.6	4.3

Tables 5 and 6 show the benefits and costs from implementing the commercial measures for the low and high take-up rate scenarios using three different discount rates. In aggregate, these measures are highly cost effective, with the present value of benefits by a factor of 4.3 (with 7% discount rate). The strong benefit cost ratio for both scenarios suggests that the rates of retrofit implied are well within the capacity of the market to deliver and do not incur rising marginal costs at the scale modelled.

Table 5 Benefits/costs (low take-up rate)

Present value of benefits (7% discount rate)	$118.67
Present value of costs (7% discount rate)	$27.29
BCR	4.3
Present value of benefits (5% discount rate)	$137.04
Present value of costs (5% discount rate)	$28.99
BCR	4.7
Present value of benefits (3% discount rate)	$159.42
Present value of costs (3% discount rate)	$30.87
BCR	5.2

Table 6 Benefits/costs (high take-up rate)

Present value of benefits (7% discount rate)	$319.69
Present value of costs (7% discount rate)	$74.50
BCR	4.3
Present value of benefits (5% discount rate)	$369.82
Present value of costs (5% discount rate)	$79.16
BCR	4.7
Present value of benefits (3% discount rate)	$431.05
Present value of costs (3% discount rate)	$84.29
BCR	5.2

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